SCIENTIFIC AMERICAN

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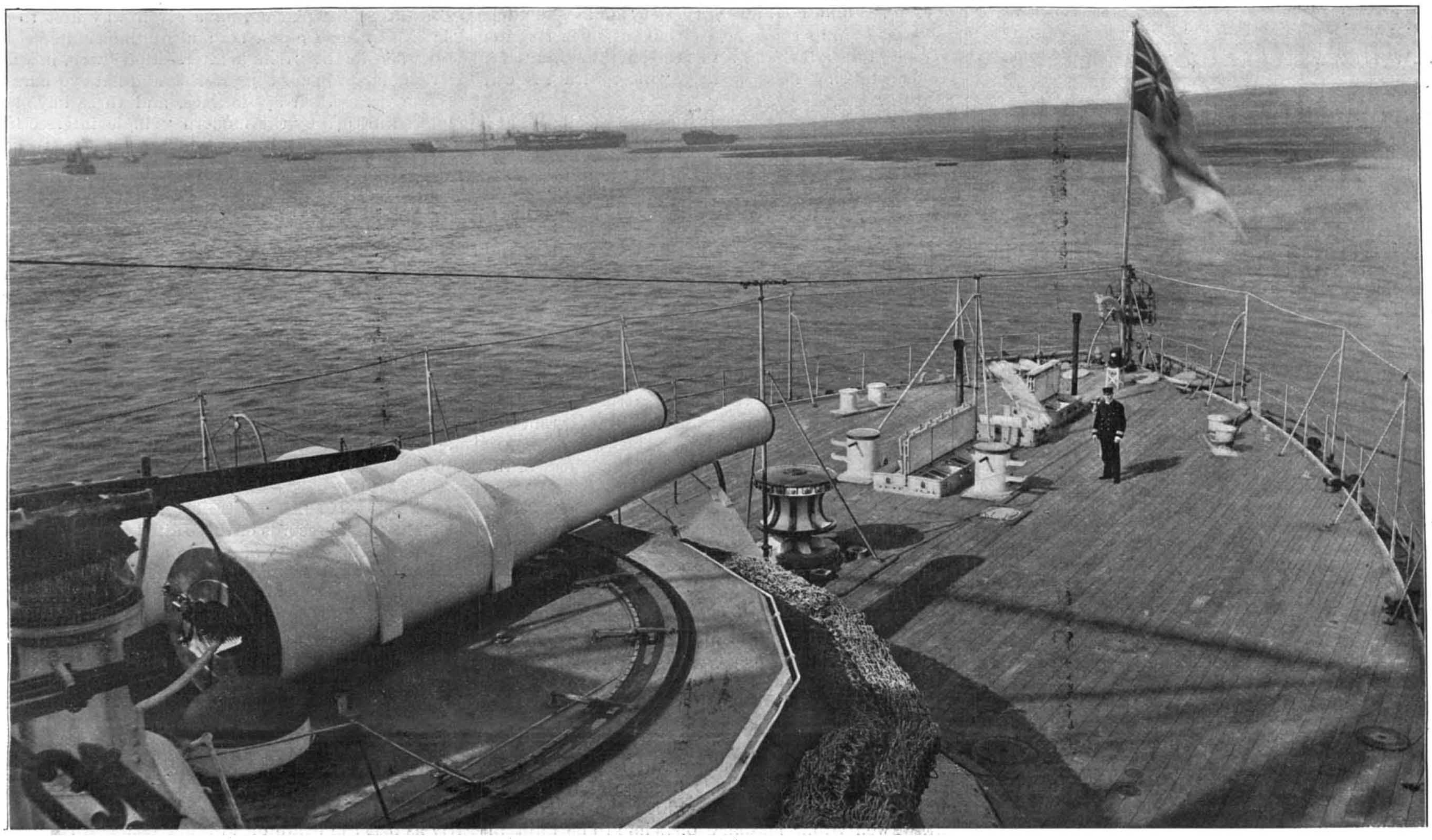
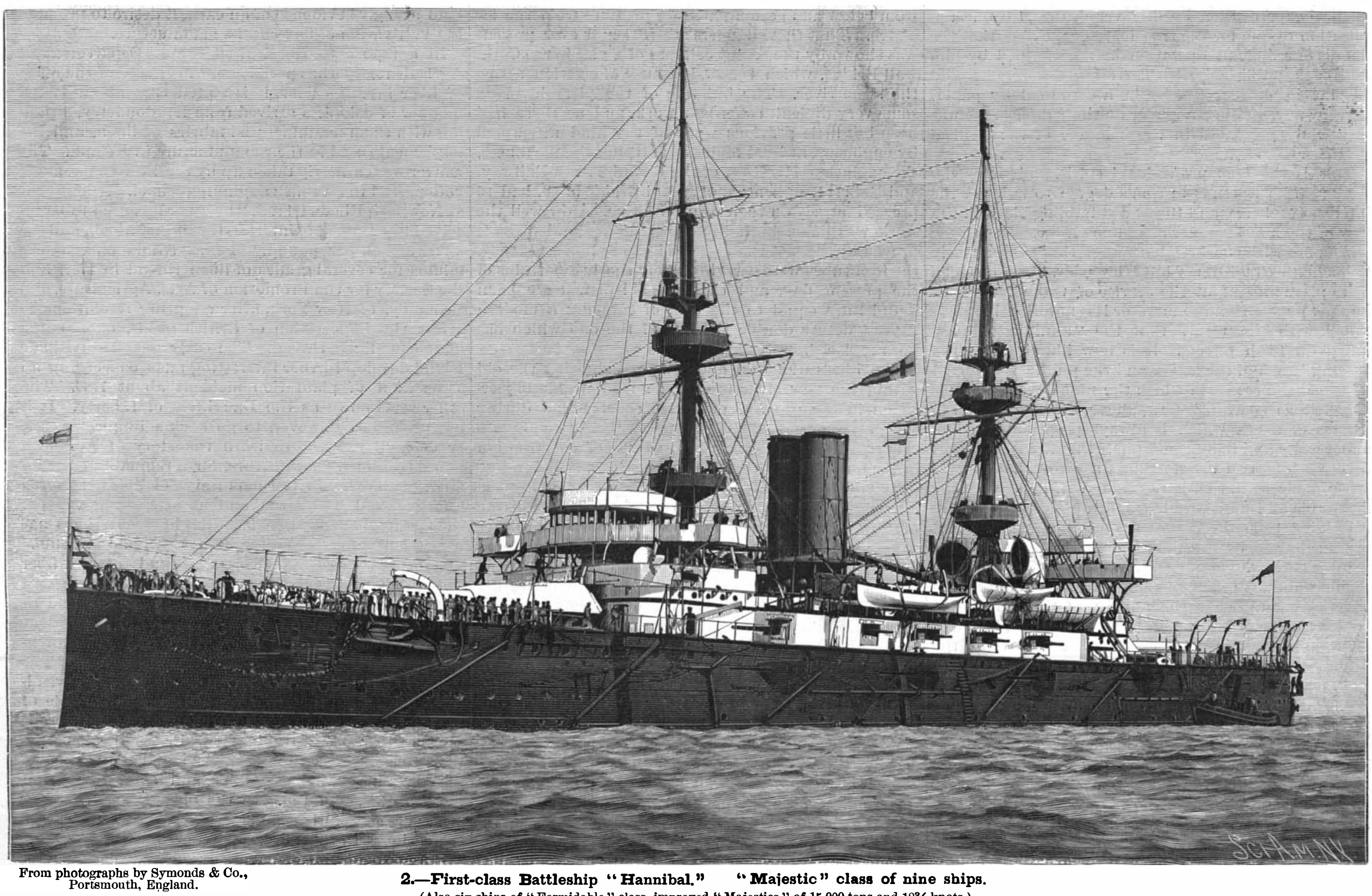


1.—After pair of 12-inch guns on the Battleship "Collingwood," showing method of mounting in barbette.

"Admiral" class: Number in class, 3. Four of the "Admirals" carry each four 13½-inch guns, and one, the "Benbow," two 16¼-inch guns.



From photographs by Symonds & Co., Portsmouth, England.

2.—First-class Battleship "Hannibal." "Majestic" class of nine ships.

(Also six ships of "Formidable" class, improved "Majestics" of 15,000 tons and 18¾ knots.)

Displacement, 14,900 tons. **Speed,** 17·5 to 18 knots. **Bunker capacity,** 1,850 tons. **Armor:** Belt, 9 inches by 18 feet deep; barbettes, 14 inches; casemates, 6 inches; deck, 2½ inches flat, 4 inches slopes. **Armament:** Four 12-inch wire guns; twelve 6-inch rapid-fire; sixteen 3-inch rapid-firers; twelve 3-pounders; eight machine guns. **Torpedo Tubes,** five (four submerged). **Complement,** 757. **Date,** 1895 to 1897.

NAVIES OF THE WORLD—I. GREAT BRITAIN.—[See page 344.]

Scientific American.

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SCIENCE AND SENSATIONALISM.

One of the most astonishing features in the development of modern journalism is the magnitude and successful audacity of the Sunday issues of the great daily papers, and among these there are none quite so successful in self-advertisement, with the unthinking half of the public at least, as those issues which are marked by the distinctive characteristics of yellow journalism.

Now, the yellow journal is nothing if it is not sensational, and in its quest for startling novelties to whet the palate of its readers, it invades every possible sphere of human life and interest and every branch of human knowledge. Science, which, one would have thought, would be severely let alone, is a favorite hunting ground of the reporter, and whole pages of the yellow journal seventh-day editions are loaded down with pseudo-scientific pabulum, upon which the Sunday reader is supposed to satisfy his hunger for scientific knowledge. The reporters for these journals are apparently sent out into the domains of science charged with a commission to magnify mole hills into mountains and use such facts as they may pick up as texts for exuberant essays, in which rhetoric gorges itself with superlatives and becomes positively tipsy with the fumes of its own wild imaginings.

Hence it is by the merest promptings of self-respect that the average man of science shuns the noisy notoriety of a Sunday paper "write-up," and reserves his announcements for the columns of the technical and scientific journals, or a lecture desk in the auditorium of the learned associations. The practice, the etiquette, we had almost said the ethics, of scientific research agree in rebuking the former and approving the latter method of making public announcement of results actually accomplished.

We shall not soon forget the extreme mortification exhibited in our presence on a recent occasion by a medical expert when he discovered, through our application to him for the true facts of the case, that the details of a difficult operation just performed by him had been published, with flattering encomiums and the inevitable inaccuracies, in a certain daily paper, thereby anticipating a paper on the subject that was to be duly presented in the columns of the medical journals.

This is the true professional spirit, and every departure from it tends in some degree to subvert the interest of science, and throw a stumbling block in the way of the honest seeker after knowledge.

We note with considerable regret that subsequently to his first extraordinary interviews, Mr. Tesla has seen fit to place himself at the service of those New York Sunday papers that are more or less notoriously sensational, with the result that the "annihilator" has taken on fresh terrors. It is now illumined by the flaming brush of the artist, and the public is diverted with realistic scenes in which the nine days' wonder is depicted as speeding, now above, now beneath the surface of a sea which is always propitiously calm, under a sky and in an atmosphere that are ever opportunely bright and clear, against a ship that is ever fortuitously within easy range, and always with the inevitable and unutterable result!

Judging from the comments of the scientific and technical press, we are not alone in our expressions of regret that any one of Mr. Tesla's undoubted ability should indulge in such obvious and questionable self-advertisement. That the author of the multiphase system of transmission should, at this late day, be flooding the press with rhetorical bombast that recalls the wildest days of the Keely motor mania is inconsistent and inexplicable to the last degree.

The facts of Mr. Tesla's invention are as few and simple as the fancies which have been woven around it are many and extravagant. The principles of the invention are not new, nor was Tesla even their original discoverer. While the present application of these principles is novel, there is nothing whatever in the device to warrant the sweeping claims which have been made in regard to its destructive powers. The connecting cable in the dirigible torpedo is only one of many insuperable obstacles to its success. Mr. Tesla has removed (or rather believes that he has) this one defect; let him now apply himself to mastering the others. Before he announces his ability to blot the navies of the world out of existence, let him answer a few pertinent questions, as follows:

If the torpedo must be seen to be controlled, and is scarcely visible at a distance of over a mile, even in a calm sea, how, in view of the great range, rapidity and accuracy of modern rifles, is the operator to keep within striking distance of the enemy? If the course of the torpedo can with difficulty be followed in calm weather, how will it be traced when the surface is disturbed even by a moderate sea, to say nothing of more boisterous water? Furthermore, what becomes of its accuracy in thick or foggy weather? The apparatus employed by Tesla is extremely sensitive to shock; how then will it fare amid the terrific concussion of a modern sea fight? If one of these weapons should be lost sight of in its course, does it not at once threaten friend and foe alike, and is not the operator himself in danger of being incontinently "hoist with his own petard"?

Lastly, and most pertinent question of all: What is to prevent the enemy from installing a transmitter on his own ship and himself sending out waves to act upon the receiver in the torpedo? We fail to find any provision made for this contingency, either in the patent or in any of the published interviews of the inventor. With a transmitter in the hands of the enemy the proper sequence of the motions of the torpedo could be destroyed, and the control of it prevented.

THE REMOVAL OF A GREAT ENGINEERING LANDMARK.

Engineers the world over will naturally feel some sentimental regret as they witness the removal of the great tubular bridge across the St. Lawrence at Montreal, which, for half a century, has formed one of the most notable landmarks in the development of the art of bridge construction. At the date of its erection it was unquestionably the largest bridge in existence. No structure of the size, or involving so many or so great untried problems of construction, had ever been attempted in the history of engineering, and an undertaking like this, which would be of the first importance even at this late day, becomes positively daring and colossal when we bear in mind that it was inaugurated when the science and art of modern bridge building were in their very infancy.

Apart from the magnitude of the work in respect of its great length (6,592 feet) and the immense amount of material (10,000 tons of iron and 100,000 cubic yards of masonry) employed, special credit is due to those engineers of half a century ago because of the exceptional difficulties of the site on which the bridge was built. Twenty-four masonry piers had to be built in one of the swiftest of the large rivers of the world, where they were exposed to the double danger of scour from below and accumulated ice pressure from the ice above. That these dangers are real and ever present was shown by the recent collapse of a pier in the Cornwall Bridge, which is now in course of erection across the same river. The building of the piers involved some very difficult cofferdam work, and as there had been but little previous work of the kind attempted by engineers, at least under such trying circumstances, the engineers, Mr. Ross, of the Grand Trunk Railway, and Robert Stephenson, of Menai Bridge fame, had to proceed largely on their own initiative. How well the work was done, both in superstructure and piers, is proved by the fact that, after a lapse of half a century, the iron tubes were carrying safely the heavy trains of the present day, and that the old piers have been found fully equal to the task of carrying a modern superstructure double the size of the one which has been replaced.

The illustrations on another page showing the old within the new structure form an admirable object-lesson in the progress of bridge construction during the past fifty years. The square tubes of solid plate iron represented the accepted theories of construction in the forties and fifties, just as the open, skeleton-like pin-connected trusses of the new bridge embody the latest ideas of long-span structures at the close of the century. The change from the one style to the other has been very gradual. It has been brought about partly as the result of a clearer apprehension of the principles which govern the strains in engineering structures, and it is partly due to the improvement which has taken place in the materials of construction.

In early days the strength of materials had not been determined with the accuracy which marks the modern testing laboratory, nor did they possess that uniform quality which we now look for in the product of our rolling mills. There was a certain measure of distrust inseparable from work which, for want of precedent, was frequently of an experimental character.

The simple wooden beam thrown across a creek is the simplest form of the bridge, and the earliest attempts at building iron bridges, of the beam as distinguished from the arch construction, show a reluctance to depart from the solidity of the prototype. The tubes of the Menai and Montreal bridges were simply hollow beams, and as such contained an excess of material above that which would be necessary to provide the same degree of strength in a bridge of modern construction.

As the advantage of depth in providing maximum stiffness and strength with a minimum of material came to be recognized, we find the ratio of depth to length, which in the tubular bridge was one to fourteen, gradually increasing until one to eight and one to six are to-day common ratios. Thus, comparing the old and the new Montreal bridges, we have for the tubular structure a depth of 18 feet for a length of 247 feet, as against a depth of 40 feet for a length of 254 feet. The shallow depth produced very high strains in top and bottom members of the tubes, and in the Menai Bridge these are massive cellular structures of great weight. The web systems, which in the tubes are solid plating, have given way first to the "lattice" web, composed of multitudinous intersecting bars, then to the "double intersection" web, in which rectangular posts for compression and flat eye bars for tension made their appearance, and these have been replaced in turn by the modern "single intersection" system, in which the last ambiguity as to the strains is removed and the construction is greatly simplified. In place of the single solid plate top and bottom chords, we have each web system associated with its own separate chords—a latticed rectangular construction being used for the top chord, which is, of course, in compression, and flat eye bars for the bottom chord. The moving loads are carried by a system of longitudinal stringers and transverse floor beams, the latter being carried at the panel points.

The modern pin-connected truss bridge is, perhaps, the most perfectly scientific structure in the engineering world. The static stresses to which it is subjected under given conditions of loading are known to within a few score pounds, and not a pound of material is put into it that can be called superfluous.

FLAX CULTURE IN THE UNITED STATES.

The historical records of the United States, says The Journal of the Society of Arts in a recent issue, show that flax culture was one of the earliest of colonial industries, and until comparatively recent years the culture and manufacture of flax in America have been household industries. American colonists brought with them the art of raising flax and of preparing and spinning it by hand, and even fifty years ago the custom prevailed among farmers of growing flax and having it retted, scutched, hackled, and spun by members of their household. In the history of Lynn, Massachusetts, it is stated that about the year 1630, "they raised considerable quantities of flax, which was retted in one of the ponds, thence called Flax Pond." As early as 1662 the State of Virginia enacted that each poll district should raise annually and manufacture six pounds of linen thread. All the records of New England also give evidence of an earnest desire to promote the cultivation of flax and its manufacture.

In a report to the United States Department of Agriculture by the special agent in charge of the office of fiber investigations, it is stated that about 1778 a number of colonists arrived from Londonderry, bringing with them manufactured fabrics of linen, and the implements used in their manufacture in Ireland. The matter was earnestly taken up by the Bostonians, and a vote passed to establish a spinning school. About 1721, at Newport, Rhode Island, "hemp or flax used to be received in payment of interest, the former at 8d., and the latter at 10d. per pound." Pennsylvania offered premiums for several grades of linen thread in 1753, and the Society for the Promotion of Arts, Agriculture, and Economy, of New York, after adopting resolutions to arrest the importation of British goods, offered premiums for linen thread. The early records of Rhode Island develop further interesting facts concerning an association of plantation maidens about 1766. The order was known as the Daughters of Liberty. It is not necessary, however, to go back a hundred years, or even fifty years, to learn the story of American household linen manufacture, for a remnant of the industry still exists in the mountains of Virginia, North Carolina, and Tennessee, and an interesting series of the fabrics made in these localities in recent times has been secured for the United States National Museum.

Sixty years ago, about 750,000 pounds of flax fiber were produced in the United States, and flax was sent to market from Connecticut that was as strong and as good as any raised in the United States at the present time. Very strong and flexible flax also came from northern New York and Vermont, but it was not clean. The poorest flax of those days came from New Jersey, although it is said that that State has been capable of growing flax equal to that of Archangel. At the present time flax is largely grown in the United States for seed, the straw, of inferior quality, when used at all, going to the tow mills or the paper mills, and being worth from 4s. 2d. to 33s. 4d. a ton. In the older States the area under present cultivation is very small and is steadily decreasing. In the newer States, or States where agriculture is being pushed steadily westward from year to year, the area under cultivation about holds its own, taking one season with another. Cultivation for fiber is beginning to attract attention, however, and the

Department of Agriculture is striving to re-establish this important industry in the United States.

By experimentation in fifty or more localities in the United States where flax cultivation was thought possible, the department has proved the fallacy of the opinion widely prevalent less than a decade ago, that flax could not be produced commercially in the United States. By these experiments it has not only been proved that commercial flax production is possible, but that good fiber and good seed with careful culture can be produced in the same plant. The most important results have been obtained on the Pacific coast, where, as in the Puget Sound region of Washington, an ideal flax climate has been discovered. Experiments here have shown that for the flax culture the Puget Sound region is the equal in climate to some of the best flax-producing regions of Europe. The superior quality of straw produced, which resembled the straw of the famous Courtrai region of Belgium, attracted the attention of the Barbour Company, of Lisburn, Ireland, resulting in this firm undertaking a retting experiment in Ireland with a ton of Puget Sound straw. The experiment demonstrated that it is possible to produce very fine fiber and good seed in the same plant.

It is stated that if the flax is grown and manipulated under proper conditions, and by people who thoroughly understand their business, in Puget Sound, the cultivation of it would be of the greatest importance and in a short time would rival the great Belgian district of Courtrai. The flax plant is now widely distributed throughout the world. It is cultivated in portions of South America, especially in Argentina, though more for seed than for fiber. It is produced commercially to a greater or less extent in Great Britain (Ireland especially), Sweden, Denmark, Holland, Belgium, France, Germany, Austria, Spain, and Portugal. It has been introduced into Algeria, and into Natal. In India large tracts are under cultivation, though more for the seed crop than for the fiber.

Japan has introduced its cultivation commercially, and it has been experimented with in the Australian colonies, where there is a wide range of soil and climate suited to its growth. The special agent of the Department of Agriculture says: "There is no doubt about the ability of the inhabitants of the United States to grow commercial flax if the people will only make beginnings, and go to work in earnest with the idea in view first to establish the industry, and to make money out of it afterward. The time is ripe for the establishment of the industry, as is proved by the profound interest that has been awakened in our experiments by foreign manufacturers."

THE LOSS OF THE "MARIA TERESA."

The painful news of the abandonment of the "Maria Teresa" as she was being towed from a Cuban port to Norfolk Harbor has been followed by a report from Captain McCalla, of the United States navy, stating that there is practically no hope of saving the vessel, which, as our readers are aware, was, subsequently to her abandonment, cast ashore on Cat Island, Bahamas.

The "Maria Teresa," it will be remembered, was used by Admiral Cervera as his flagship in the Santiago engagement. She headed the squadron as it issued in single column from the harbor, and she was the first to open the battle and receive the concentrated fire of the American fleet. She kept up the running fight for over seven miles when fire broke out between decks, and she was run ashore.

In the subsequent examination by the naval board it was found that she had suffered less injury from fire and the guns of our fleet than either of the sister ships "Vizcaya" and "Oquendo." The frames above water were practically intact, and while the deckbeams and bulkheads above the protective deck were warped by the heat, the bulkheads, longitudinal and transverse, below this deck were generally in good condition, thus insuring the integrity of most of the watertight compartments. The outside plating, moreover, was in good condition. The effect of gun-fire was less severe upon her than the other vessels, and she escaped the magazine and torpedo explosions which completely wrecked the "Vizcaya" and "Oquendo." The shot holes dangerously near the waterline were made by two 6-pounders, a 4-inch, a 6-inch, two 5-inch, and two 12-inch shells.

In agreement with the recommendation of the board wrecking operations were commenced, and subsequently carried to a successful completion under Lieut. Hobson. The greatest obstacle encountered was a point of rock which had pierced the bottom near the forward turret. This had to be blasted away and a cofferdam built over the hole before the ship could be floated. She was subsequently pulled off and towed to Guantanamo Harbor, where temporary decks were laid and the vessel put in trim for the trip to Norfolk navy yard. She ultimately got away under her own steam and in tow of the wrecking tugs, accompanied by the repair ship "Vulcan." Good headway was made until heavy weather was encountered, in which the "Teresa" began to labor heavily and take in a considerable amount of water. The heavy pumping machinery on board was unable to control the water, the suction becoming choked with coal and the wreckage of the ship. She settled by the head, and the commanding officer, thinking she was about to go down, cut the tow ropes and left the ship to its fate.

The watertight compartments, however, kept her afloat, and she was ultimately driven by the storm upon the coast of Cat Island. Capt. McCalla was immediately dispatched to the wreck, and reported that it was hopeless, in his opinion, to expect the rescue of the ship. He says:

"The wreck is stranded in from sixteen to twenty-one feet of water, and rests on a rocky reef covered with coral sand interspersed with bowlders.

"I spent Sunday on the wreck, examining carefully all the compartments which were not flooded, as well as the ship's surroundings. The evidence showed that after striking the reef the mainmast was driven up and broken off short below the spar deck, the military top lying outside the bilge under the port quarter.

"Seas had gone entirely over her and the inner bottom generally had been driven upward from 1½ to 2 feet. A patch on her bottom abreast the forward turret had disappeared. The air ports had been driven in and the seas had entered through them and the gun ports on the starboard side. The spar deck and deckhouses had been crushed in by seas after the ship struck. Both starboard and port engines have been forced up by from six to eight inches.

"The best way to illustrate the general condition of the wreck is to say that the two sets of engines, boilers, and their foundations form part of the reef itself, around which the rest of the ship works laterally and vertically. The same effect would be produced, in my opinion, if the ship had settled on a pinnacle of rock. I can best describe the condition of the ship generally by saying that she is already telescoped, and I believe that, as the rivets are sheared by the constant working of the ship, the telescopic process must continue. In considering the practicability of rescuing the Teresa,' the fact must be considered that she lies upon a coral reef with but a thin layer of sand on the windward side of an island, constantly exposed to seas, due to the trade winds and to the influence of many storms developing to the eastward or southward."

It must be evident to the most sanguine that the "Teresa" will never figure on the official lists of our navy.

Interest now centers in the "Christobal Colon." The government has abandoned its wrecking operations; but there is a possibility that the work of saving her may be undertaken by the Swedish wrecking company that performed the seemingly impossible feat of raising the British battleship "Howe" in Ferrol Harbor.

THE NOVEMBER METEORS.

Some brilliant Leonid meteors were observed on the morning of November 15. Some of the brightest meteors were not far from the constellation Leo. One particularly bright one fell from the constellation Taurus leaving a trail of phosphorescent brilliance. Others came from the direction of Ursa Major. The display was disappointing. In the last Leonid shower in 1866, 8,000 meteors were counted at one observation station, but the shower of 1866 did not compare with the one in 1833, when the number of the meteors made some people think the world was coming to an end. Prof. C. A. Young, of Princeton University, observing with an assistant, reports that he saw 100 Leonid meteors on the morning of November 15. He said, "My assistant, Mr. Reid, and myself conducted the observations, which were much more successful than I thought they would be. Between the hours of 3:15 o'clock and 5 o'clock we saw about 100 meteors which were Leonids, that is, they belong to the meteoric swarm that gave the shower. Perhaps one dozen were as bright as first magnitude stars. The rest were faint and left trains which continued from one to ten seconds. The maximum of the shower was at 3:45 o'clock, at which time there were two or three meteors per minute for about twenty minutes. The radiant point seemed to be in the Sickle of Leo and a little further south and west than in 1866. It was a distinctly meteoric shower, but a very faint one, and augurs well for a good display in 1899."

Prof. Rees, of Columbia University, saw no Leonids. "As a matter of fact," says the Professor, "I saw only two meteors. They came from the direction of Ursa Major, and not from Leo, as had been expected. I watched the sky every hour from sunset to sunrise between the southwest and the west."

At the Yerkes Observatory, Williams Bay, Wis., the shower was also observed. The fore part of the evening the sky was overcast, but about midnight the sky cleared, and in a short space of time, during which they were visible from the observatory, 200 meteors were seen. Dr. William L. Elkins, of the Yale Observatory, photographed 30 meteors. Six cameras were used, two at the observatory, two from the church steeple, and two in one of the suburbs. Prof. Prentiss, of Rutgers College, states that while the display of the meteors was not unusual, this scarcity is not regarded by astronomers as a disappointment; furthermore, they are valuable indications of large showers of meteorites for 1899 and 1900.

LATIMER CLARK.

With the death of Latimer Clark, on October 30, the number of those who are connected with the earlier developments of land and submarine telegraphy has become greatly reduced. We now have only Lord Kelvin, Sir Samuel Canning, and Messrs. Bright, Webb, and Clifford.

Mr. Clark was born in 1822, and in his early youth showed a strong taste for chemistry, and he soon obtained a position in a chemical industry. In 1847 he became assistant engineer to the Electric Telegraph Company, and on the retirement of his brother a short time later he was appointed engineer of the company. His first telegraph work which brought him into notice was the employment of electricity in firing a time gun. He devised an excellent insulator and also a pneumatic system for transmitting telegraph messages. His field of professional activity constantly extended itself and he became engineer-in-chief of various companies. Mr. Clark was the first to draw attention to the retardation of electricity in a covered wire by induction and to insist that a high potential was of no advantage for the transmission of signals through cables. In 1861, Mr. Clark associated himself with Sir Charles Bright, and this firm acted as engineers for the construction and laying of nearly all the early telegraph cables. In the same year these gentlemen read a paper before the British Association on electrical standards and units, in which, for the first time, a definite and practical system of electrical measurement was suggested and adopted. The two engineers conducted many experiments on the effect of temperature on the electrical resistance of gutta percha and deduced from this a formula for correcting the resistance to a standard temperature. They also acted as engineers for the purpose of making and laying the second and third Atlantic cables. In 1868 the partnership was dissolved and the new one was formed, headed by Mr. Clark, and this firm was connected with the laying of 60,000 miles of submarine cables. The Clark standard cell is well known. The year 1898 has been most unfortunate on account of the death of many electricians, including Dr. John Hopkinson, Camille A. Faure, and Latimer Clark.

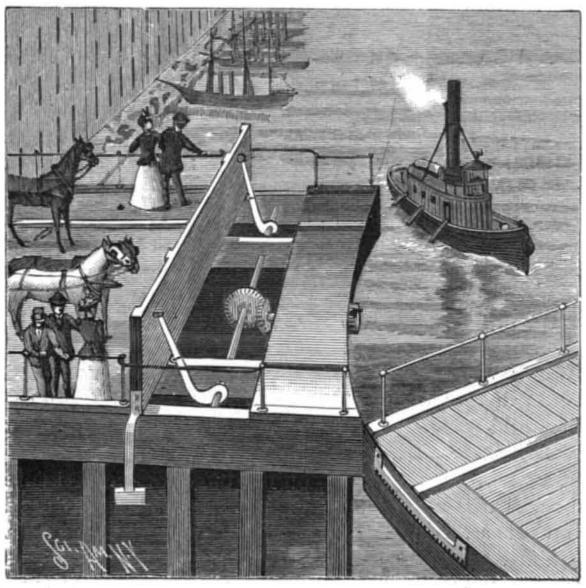
A USEFUL BEETLE.

Entomologists are interested in the shipments made by Dr. Howard, Entomologist of the United States Department of Agriculture, of beetles to the Department of Agriculture, Portugal. The beetle is known as the Novius cardinalis. Its home is in Australia, and it was introduced in California several years ago by the Board of Horticulture of that State. It was hoped it would prey upon the white or fluted scale, which was ravaging the orange groves of California at that time. A similar case has occurred in Portugal, and the Portugal authorities asked the United States authorities to aid them in exterminating the insects, which were destroying the orange and lemon groves along the River Tagus. Dr. Howard secured about sixty specimens from California, with some larvæ. They were packed in moss, with a quantity of the scale insects, and they were shipped by mail to Portugal. Only five of the beetles survived the trip, and another colony was obtained from California, and was forwarded by direct steamship to Lisbon. One male and five females survived. These beetles are noted for their fecundity, and within a few months their progeny numbered thousands. These were distributed to work upon the scale bugs. The latest advices from Washington indicate that the beetles now number millions and are rapidly ridding the country of the pest. This is only another instance of the good work which this important department of the government is performing. We frequently get inquiries relating to soils, entomology, etc., from correspondents in foreign countries, and invariably we receive answers from the heads of the different divisions of this department which show that their scholarship is only equaled by their courtesy.

"POSSIBLY the wholesale deforesting of the Colorado mountains by the fires that have been raging there for many days may have a useful effect in hastening the time when tree planting on a large scale will be undertaken not only there, but throughout the country," says The Philadelphia Ledger. "The great middle West is already very much alive to the importance of preserving its water supply; and if the destruction of the forests shall have its anticipated effect in diminishing the streams, it will not be long before the people of that section will throw their characteristic energy into the business of replacing the forest growth and extending it as far as may be necessary. From them perhaps we in the East, who have witnessed with so much indifference the destruction of our own forests, may possibly catch the enthusiasm and make some worthy effort to replace our vanished trees. If all this should follow, the burning of the Colorado timber will be a blessing in disguise."

AN AUTOMATIC SAFETY-GATE FOR BRIDGES.

A safety-gate which is automatically opened and closed by the action of the draw or swing sections of bridges has been patented by Wallace W. Heffron and Frank T. Rice, of Tower City, North Dakota. Referring to the accompanying engraving, it will be observed that the gate is pivoted upon the upper face of a bridge span, and can be raised into a vertical position or lowered into a horizontal position. When lowered, the gate constitutes a portion of the driveway and foot-path of the bridge. Below the gate a shaft is transversely journaled. To the shaft and to the gate, jointed levers are attached in the manner indicated. A second, longitudinal shaft is journaled at right angles to the lever-shaft, and at one end has geared connection with the lever-shaft. At the other end,



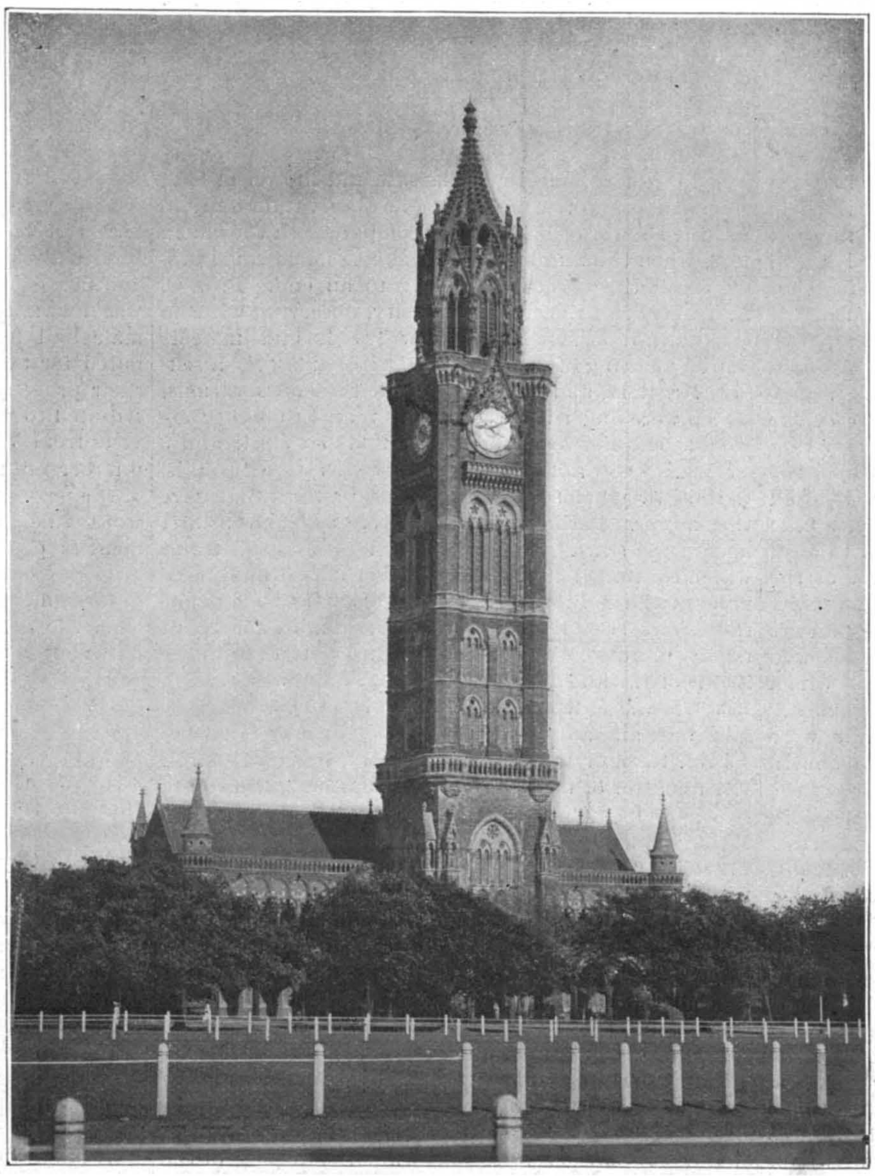
AN AUTOMATIC SAFETY-GATE FOR BRIDGES.

the second shaft is provided with a pinion adapted to engage two cog racks on the draw. One rack is attached to the end of the draw at one side, with its teeth directed downwardly, as shown in the engraving; the other rack, not pictured in the cut, is secured to the draw at the other side, extends some distance below the first rack, and has its teeth directed upwardly. A transverse as well as a vertical space is left between the two racks, which space is occupied by the pinion in its normal, inoperative position. Counterweights are employed to facilitate the operation of raising the gate. When the draw is swung toward the left, the upper rack will engage the projecting pinion of the longitudinal shaft, and, communicating its motion to the jointed levers, through the medium of the two shafts, will raise the gate to form a barrier extending across the driveway and footpaths. When the gate has attained its vertical position, the rack will have passed the pinion. In closing the draw, the rack will engage and turn the pinion in the reverse direction to cause the gate to be lowered. When the draw is to be moved toward the right, the lower rack is brought into action.

THE UNIVERSITY OF BOMBAY.

Doubtless few of our readers have visited India, but we are very certain that those who have, found a great surprise awaiting them. We naturally associate India with the peculiar style of architecture which is indigenous to that country, but the truth of the matter is that in a number of cities, and especially in Bombay, there are many buildings which would be notable in London or Paris. We have already illustrated the great railway station at Bombay, which is one of the finest buildings for this purpose in the world, and the University is also specially worthy of note.

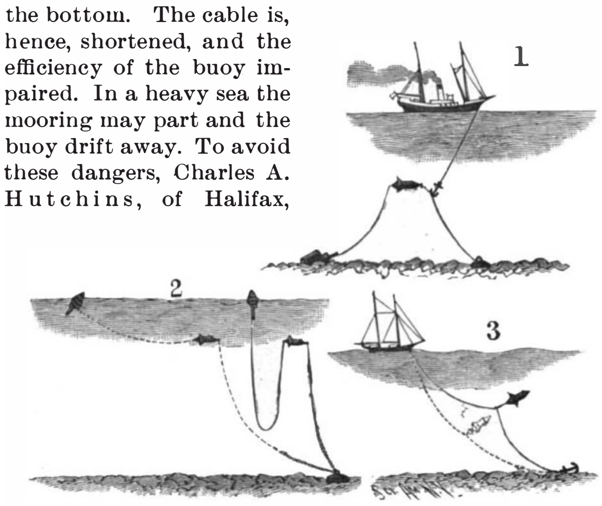
Through the courtesy of Mr. I. N. Parmanand, of Bombay, we are enabled to present an interesting engraving of one of the University buildings. Next to the huge Secretariat are two smaller buildings, both by the late Sir Gilbert Scott. The first is the Senate Hall of the University, and the second the University Library and Rajabai Clock Tower, which forms the subject of our engraving. The University Hall is 104 feet in length, 44 feet in breadth, and the height is 63 feet to the apex of the groined ceiling. The semicircular apse is 38 feet in diameter. The University Library and clock tower were designed by Sir G. G. Scott and carried out by the detail drawings prepared by Mr. Molecey, the resident architect. The total length of the building is 152 feet. The ground floor contains two side rooms each 56×30 feet and a central hall 30×27¼ feet. On the west front is the tower forming a carriage porch 26 feet square inside measurement and 36 feet outside, so the walls are each 5 feet thick. Along the west front is an open arcade 14 feet wide with round open staircases at either end leading to the floor above. The upper floor is devoted to the library and reading room, which consists of one room extending the whole length of the building, and the height to the apex of the arched paneled roof is 32 feet. The tower itself forms a conspicuous feature in the panorama of Bombay. It is 280 feet high from the ground to the top of the metal finial. The height of the first stage, where the square form is changed, is 68 feet. The second stage, to the top of the tower, is 118 feet, and the third stage, to the top of the finial, is 94 feet, making a total of 280 feet. The height to the center of the clock dial is 167 feet. The external diameter of the dial is 16½ feet. The staircase of the octagonal vestibule is groined in porbunder stone, the ribs springing from corbeled dwarf columns. The landing to the staircase is 9 feet wide. This is also groined underneath, the two cross arches springing from the carved corbeled heads of Homer and Shakespeare, which are ingeniously carved out of the capitals of two large columns supporting the walls above. The belfry contains the peal of bells, struck mechanically. From the top of the tower a magnificent view may be obtained, not only of the town and harbor, but also of the country on one side and the sea on the other for many miles. Fifteen feet above the gallery, in niches cut in the pillars which form the corners of the octagon, are large figures, each 8 feet high, representing the different races and costumes of Western India, and higher still, some thirty-odd feet above the gallery, where the octagon ceases and the cupola commences, are another series of figures of the same description standing out boldly on the tops of the pillars supporting the angle ribs of the cupola. From the top of the octagon, the cupola gracefully rises about 52 feet, to a point on which is fixed a large round ball. The original plan contemplated a crowning feature of ornamental iron work, but this has been dispensed with. The only metal about the cupola is the lightning conductor, a copper tube 2½ inches in diameter, which runs down to the ground, and is then carried away and embedded 12 feet below the surface at a point where water was found. The work was commenced in 1869 and was completed in 1878. The entire cost of building with the clock and chimes was contributed by Premchund Roychund, and it was named the "Rajabai Tower" in commemoration of the donor's mother. The total cost of the building was 5,047,603 rupees, which is equivalent to $2,438,000, which was more than covered by the munificent gift of four lakhs and the interest thereon.

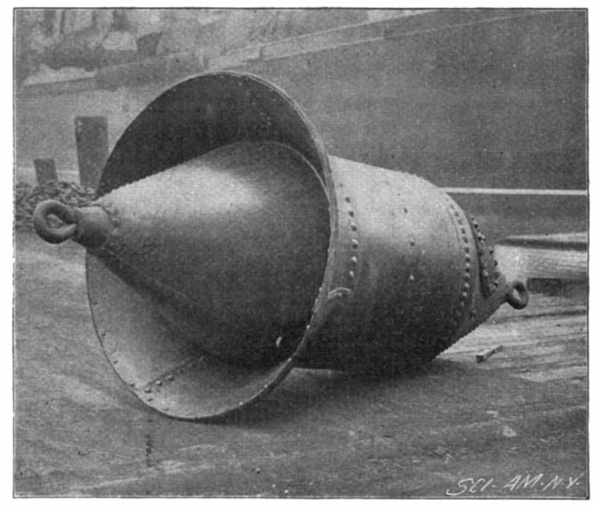


THE UNIVERSITY LIBRARY AND CLOCK TOWER, BOMBAY, INDIA.

A NOVEL WAY OF PROTECTING BUOY-CABLES.

In the use of floating buoys, it frequently happens that changes in the winds and tides cause the cable to be dragged about on the bottom and to become fouled either with itself or with the bottom. The cable is, hence, shortened, and the efficiency of the buoy impaired. In a heavy sea the mooring may part and the buoy drift away. To avoid these dangers, Charles A. Hutchins, of Halifax, Canada, superintendent of lighthouses for Nova Scotia, has invented and patented a buoy which, when submerged, holds the cable off the bottom, so that it is payed out and taken in according to the strain on the floating buoy.





A NOVEL METHOD OF PROTECTING BUOY-CABLES.

The submerged buoy, as shown in Fig. 4, has a cylindrical body with tapering ends adapted to receive the cable. The body at one end is provided with an outwardly-flaring rigid skirt, constituting a drag against the movement of the buoy through the water.

In Fig. 2 the submerged buoy is shown interposed between the sections of the cable of a floating buoy. The full lines in the figure indicate the position of the cables and buoys in calm weather, the cable in this position being at all times held above the bottom. When the floating buoy yields to the action of the sea or of the winds, the cable becomes taut, as shown in the dotted lines. When a heavy sea strikes the floating buoy, the strain on the upper cable-section is conveyed to the submerged buoy, the skirt of which, constituting a drag, breaks the greater portion of the strain and transmits but little to the mooring. It is therefore evident that the submerged buoy performs the double function of relieving the mooring of strain and of preventing the fouling of the cable. When thus insured against fouling, a cable rarely parts.

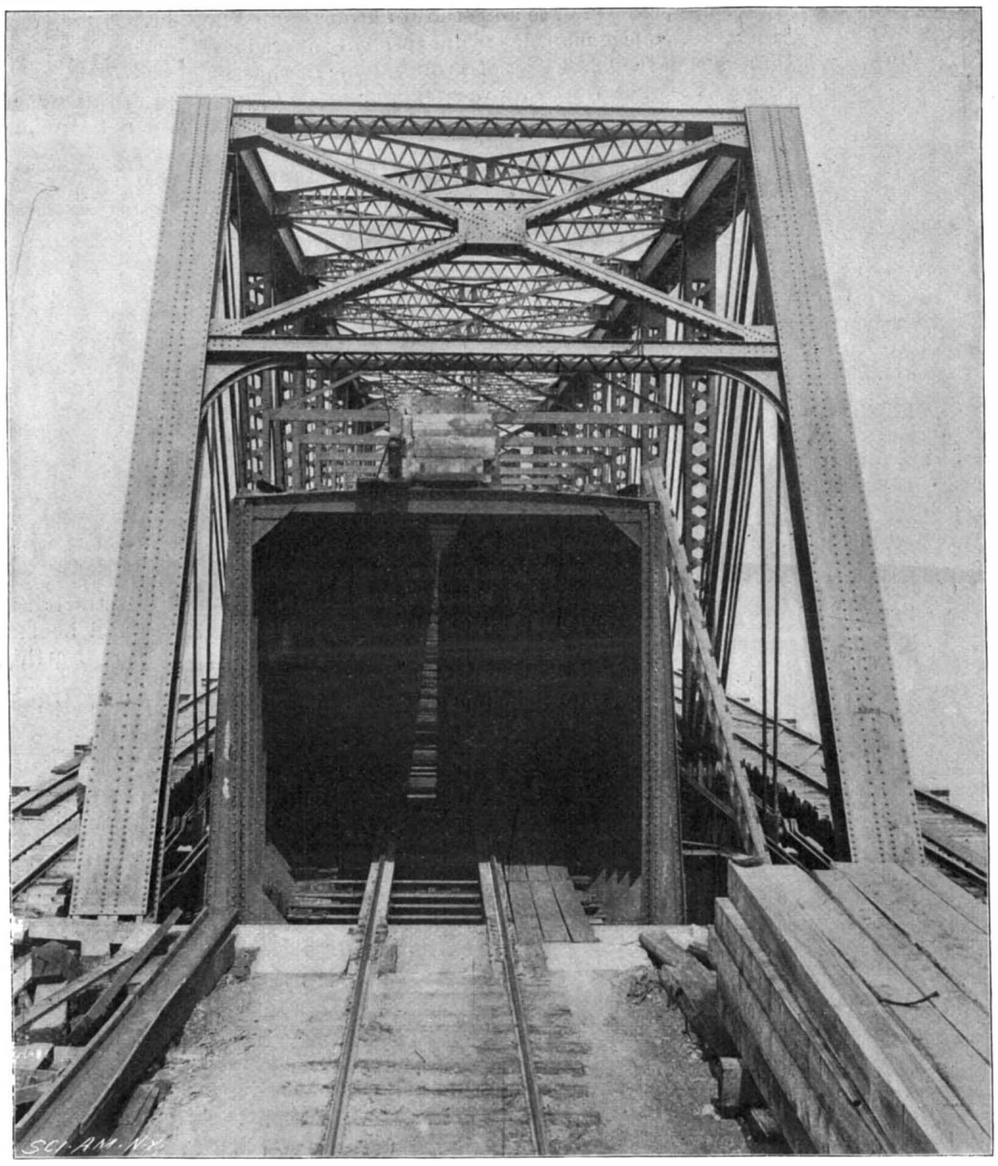
In Fig. 1 the submerged buoy is shown holding up the bight of the moorings of a sunken buoy. A cable supported in this manner may be readily grappled and the sunken buoy recovered. Without the use of the submerged buoy, grappling on rocky bottoms would be difficult, perhaps impossible.

Fig. 3 shows a vessel riding out a gale on a lee shore. The buoy in this case is attached by one end to the anchor-chain, so that when dragged under the surface of the water it will form an effective sea-anchor in addition to the anchor at the bottom.

The inventor states that his buoy has been used for over a year, on the most exposed places on the coast of Nova Scotia, and has stood the tests to which it has been subjected with gratifying results.

THE VICTORIA JUBILEE BRIDGE.

The completion of the new Victoria Jubilee Bridge across the St. Lawrence, at Montreal, will mark the disappearance of one of the most famous landmarks in the early history of iron and steel bridge construction. The new structure is being built to take the place of the old Victoria Tubular Bridge, which, built by Robert Stephenson for the Grand Trunk Railway in 1849, has now for half a century been conspicuous as one of the most notable engineering structures in the world. The old bridge, which was a tubular plate iron structure, square in cross section, was the third bridge of the kind to be built by that famous engineer, Robert Stephenson, son of George Stephenson, the builder of the first successful locomotive. The first tubular bridge of the kind was that built by Stephenson, assisted by Mr. William Fairbairn, across the Menai Straits, between the Isle of Anglesea and the mainland of Wales. It carries the tracks of the London and Northwestern Railway and forms an important link in the great mail route between London and New York. It consists of two spans of 230 feet and two of 460 feet in the clear, each of the shorter spans weighing 630 tons and each of the main spans 1,587 tons, or nearly 3½ tons to the foot. The tubes were 15 feet in width and varied in height from 23 feet at the ends to 30 feet at the center. The webs consisted of continuous solid plating and the top and bottom of the tubes were cellular in construction, the full width of 15 feet being divided in each case into 9 rectangular cells 21 inches square in section. The structure was stiffened laterally by plate gussets 5½ feet deep by 2½ feet wide, worked in at each angle of the tube. The bridge was, of course, enormously heavy, and its strength and stiffness were out of all proportion to the light trainloads of that day; at the same time it speaks volumes for the merit of the design and good quality of workmanship that a bridge designed in the forties (the first train passed through in 1850) should be carrying the heavy passenger and freight trains of the present day.



VICTORIA JUBILEE BRIDGE—END VIEW, SHOWING PIN-CONNECTED STRUCTURE ERECTED AROUND THE OLD TUBULAR BRIDGE.

The next tubular bridge was built over the Conway, at a point on the same line a few miles distant from the Britannia Bridge, and this was followed in 1859 by the great Victoria Bridge, at Montreal, which was built on the same system, but contained several modifications and improvements. It was the largest bridge in the world at the time of its erection, and even to-day must be reckoned as one of the greatest. It consisted of twenty-four spans, each 254 feet long, and one channel span of 348 feet, the total length of the bridge and approaches being 6,592 feet. The total weight of all the spans was 10,000 tons and the total cost of the bridge was $7,000,000—a sum which appears enormous in the present day, but does not seem so excessive if we remember that half a century ago engineers were not equipped with the splendid machinery and appliances which are in use to-day, and the cost of material was very much greater.

In addition to the Grand Trunk, other roads made use of the bridge, and of late years it had become overburdened with traffic. Moreover, the advantage of using the bridge for wagon, street-car. and foot-passenger traffic was obvious. These considerations finally led to the removal of the old structure and the erection of a new bridge of much greater capacity in its place. As it was necessary to interrupt the travel as little as possible, and the existing piers were found to be adequate to carry the new bridge, the engineers determined to erect the new spans around the old tubular structure and remove the latter piecemeal after the new work had been completed.

The new bridge is of the standard American pin-connected type,

THE RECONSTRUCTION OF THE VICTORIA TUBULAR BRIDGE—VIEW FROM EASTERLY SHORE, SHOWING OLD TUBULAR BRIDGE IN COURSE OF REMOVAL.

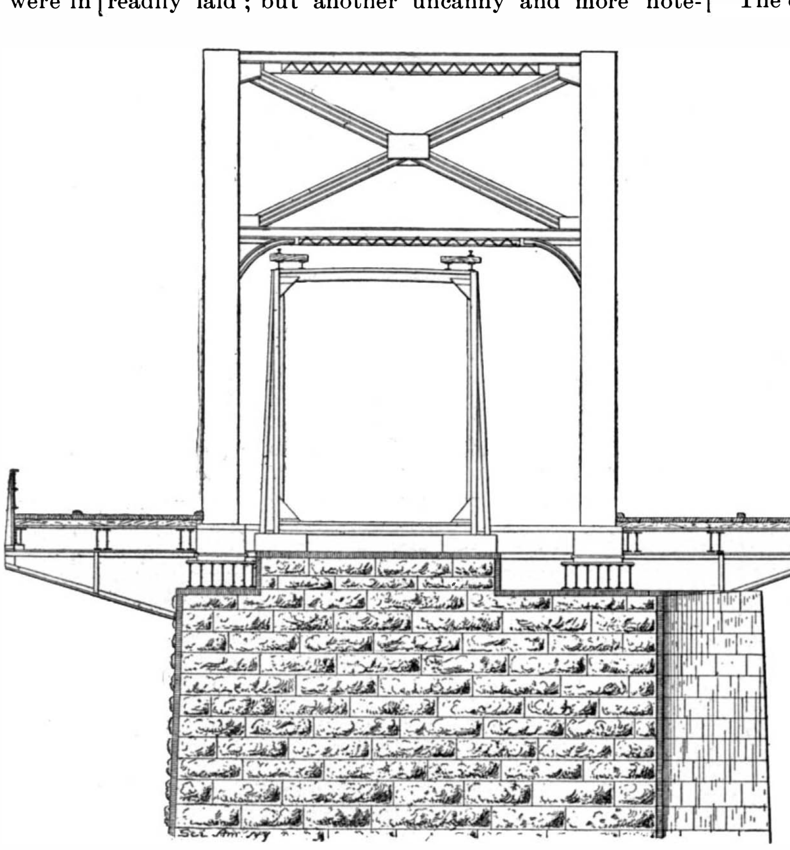
with vertical posts and inclined ties. It will have a double line of railroad tracks (the old bridge had but one), carried within the trusses, and the floor beams will be extended, as cantilevers, beyond the trusses sufficiently to provide for a roadway and sidewalk on each side of the bridge, the total width of the floor thus formed being 66 feet.

It will be noticed in the cross-sectional drawing of the bridge that two lines of rails are laid upon the top of the old bridge, one at each edge. These were used to carry a light temporary erecting truss, which was blocked up on a series of trucks to the required height, and served to carry each span of the new bridge during its erection. The traveling truss was placed over a given tube of the bridge and the chords, posts, eyebars, etc., of the pin-connected span were carried by it until they had been connected up, when the blocking was removed, allowing the new span to rest on its own bearings. The erection truss was then drawn forward onto the next tube by means of block and tackle and a stationary engine which was bolted down to the next tube ahead. The plan worked so well that only four to six minutes were consumed in moving the truss from one pier to the next. Two erection trusses were used, one on each side of the central channel span.

The reconstruction of the first span of the superstructure of the bridge commenced on December 8, 1897, and was completed on the 25th of the same month. Work was suspended during the winter and opened up again on March 23 of this year, when the erection of the second span was commenced. By August 19 the whole of the twenty-four spans were in place, and the total amount of time during which traffic had been suspended in the five months amounted to only twenty-five hours.

When the new spans were all erected and swung the tedious work of removing the old structure was commenced. This is in itself no small task. The rivets have to be cut and the multitude of parts—plates, gussets, angles, girders, etc.—must be removed piecemeal without interfering with the constantly moving traffic.

Our thanks are due to Mr. Joseph Hobson, Chief Engineer of the Grand Trunk Railway, for courtesies extended in the preparation of this article.



PORTAL VIEW OF THE TWELFTH SPAN, SHOWING ROADWAYS AND SIDEWALKS CARRIED ON EXTENSIONS OF THE FLOOR BEAMS.

New Method of Disinfection.

No sanitary subject has received more attention lately than that of disinfection. Drs. Walther and Schlossmann give the following details of a new method of disinfection: By means of a specially constructed apparatus a mixture of formaldehyde and glycerine is sprayed into a room which is to be disinfected, until a thick fog results; about 4 pounds of the mixture are needed per 1,000 cubic feet. The room need not be hermetically closed during the operation, as the ordinary circulation of air assists in spreading the disinfectant, and in enabling it to reach remote corners. Three hours' exposure was found sufficient to kill all germs in the rooms experimented on, though the test objects were purposely chosen of the most refractory nature.

For example: Pieces of linen thickly coated with a paste of white of egg and garden soil, dried in an incubator; layers of soil 3 or 4 millimeters thick with potato skins under and above them; potato skins alone. These were placed, open and covered, at various heights in the room, in recesses in the wall, on the floor, under pieces of furniture, in tall glass cylinders, or in shorter cylinders under a layer of wadding, in the pockets of thick winter clothing. Fæces were also sterilized by this exposure. Live guinea pigs and rabbits were also found to be freed from bacteria in their skins, their bedding straw, and their excrement.

The authors attribute the very advantageous effect of adding glycerine to the formaldehyde to its hygroscopic character and its power of adhering to and penetrating most of the ordinary porous materials found about a household. They anticipate that it may be found possible to diminish still further the necessary duration of the period of disinfection, and that their method will become a much more powerful agent than any yet known against the spread of infectious diseases, not only in man, but in the lower animals.—Prakt. Chem.

PRINCE ALBERT of Monaco is having an observatory built at the Azores for the taking of magnetic observations. The advantages of having a station there will be that a situation will be obtained near latitude 40°; the permanent causes of perturbation, electric lighting, tramways, etc., will not be present; and the geographical position, intermediate between Europe and America, would be capable of furnishing useful indications for the comparison of the magnetic curves obtained in these two parts of the world.

Mysteries of Sound.

Some curious experiences with regard to the trickery of sound occurred to me, says John M. Bacon, in The Strand Magazine for October, during undergraduate days at Cambridge, to which I attribute an early predilection for the science and study of acoustics. While yet an outcollege man, I was unexpectedly offered a set of rooms in the Old Court of Trinity, which rooms had been somewhat hurriedly vacated by a man of uncertain health and nervous temperament, who assigned no satisfactory reasons for suddenly going into lodgings. It was the commencement of a dull October term, and I remember well how the bedmaker warned me against with rooms, which she characterized as "dreadful dismal." The cause, however, of this forbidding description was not revealed to me till some weeks afterward, when boisterous winds chanced to set in with gloomy November weather, about which period, when sitting up reading, I used frequently to hear low, moaning sounds, as if some creature were in distress somewhere in the lane outside. No one could explain the phenomenon, and it was not until months afterward that I myself searched for the cause, and, after some little difficulty, discovered it. It was commonplace enough. In a side room a piece of wall-paper pasted across a chink had developed a crack, leaving two jagged or toothed edges, which, under certain conditions of draught, vibrated rapidly together, forming as it were a reed, and thus producing the sound above described.

That ghost, like all others in my experience, was readily laid; but another uncanny and more noteworthy occurrence shortly afterward taught me yet more clearly how capricious sounds may become, and how hard to locate or explain. In a neighboring staircase there lived (I beg pardon, "kept") another friend of mine, a man of much tougher fiber, who was reading—and over reading—for a medical examination, and once, through a sleepless night, he was driven to distraction by what, in the morning, he described as mysterious voices apparently in the court outside, accompanied by rappings on a tin tray or the like; yet, as often as he rose and went to the window, there was nothing to be seen, and at last his overwrought nerves gave way, and were not to be relieved until some of his friends succeeded in finding the cause of his disturbance, which was this: Over the way, in Caius College, where building was going on, an engine had broken down and workmen had been employed through the night in tinkering it up. This was the sole and sufficient explanation. It satisfactorily accounted for the existence of midnight voices and for the weird tappings, excited imagination supplying all the rest.

The instructive fact, however, brought home to my own mind was how unaccountably sounds may seem to behave themselves when the mind fails to interpret them aright, and how strangely different even a familiar noise may sound when heard amid dead silence. It has been my good fortune more than once since then to dispel idle imaginings that had been causing real disturbance and distress.*

Occasions also have arisen which have stimulated me to construct sound instruments which, in performing certain novel functions, should attain objects of practical value. For example, on the occasion of an annual flower show held in my grounds, it has been necessary to summon visitors, many hundreds in number, and scattered over a large area, to certain side shows. A horn or bell conveyed nothing in particular, but a specially made trumpet, rigged on a scaffold 30 feet high, commanded the whole ground, and a polite invitation gently spoken to the four winds has been easily heard by all. Some ten years ago my attention was accidentally directed toward kindred acoustical problems by circumstances which again may be considered as outside common experience. By the kindness and courtesy of the late Dean Church, I had been granted the privilege of making use of St. Paul's Cathedral for carrying out certain experiments dealing with terrestrial magnetism. I had chosen for my purpose a quiet summer's night, and, all due arrangements having been made, I commenced a long vigil, sitting alone for hours in the loftiest chamber of the building watching the readings of an instrument, while a colleague watched a similar instrument in the crypt 400 feet below. It was while occupying this elevated position, with attention well braced, and in that night silence which falls even over our great metropolis, that I learned how remarkably certain sounds can be recorded over vast distances. The measured tramp of the policeman rang as sharp or sharper than if I had been on the pavement beside him. The fog-horn of the bicycle—then in vogue—could be heard streets away, and railway whistles on distant lines and hooters on the shipping far down the river seemed unearthly in their carrying power and clearness.

The experiences of that night were further confirmed on yet another occasion when, about the same period, I chanced to make my first balloon voyage, and when, by rare fortune, our balloon drifted over the very heart of London and almost directly over St. Paul's Cathedral, at an elevation of 3,000 feet above its golden cross. It was a noteworthy voyage, and deeply impressed upon my mind afterward by the fact that it was one of the last conducted by the late Captain Dale, who shortly afterward lost his life while ascending from the Crystal Palace grounds. It was while we were maintaining a high elevation that we made out Kennington Oval immediately below us, and we could actually watch a game of cricket in progress. Soon, however, it became apparent that play was suspended, and then, manifestly in our honor, a ringing cheer came up with a distinctness that I was wholly unprepared for. I learned then that an English cheer is a very arousing, and may become a very astonishing, sound; but my wonder grew as we swept on and presently caught the gathering rattle of the streets below, which soon increased and grew to a deafening roar positively painful by its harshness and intensity. So far, these experiences were but proofs of the great carrying power aloft of loud and familiar natural noises, but I was now to be impressed quite equally with the penetration into upper air of Nature's softer music. It was squally weather that day, and, as evening approached, the wind grew rough with gathering storm. We were at that time scudding fast over Hertfordshire, where the country was well timbered, and ever as we passed high over woods, then in full foliage, a soft murmur would fill our ears, and it seemed almost incredible that this was but the tossing trees singing to us half a mile below. There were other sounds, of course. Anon would come the bark of a dog from—where? Or the whistle of a train scarcely yet visible in the distance deep down.

Altogether it was firmly impressed upon me from that time onward that a balloon ascent properly arranged would offer an exceptional opportunity for studying many problems in sound which could not fail to repay fresh investigation and experiment; and it is not a little curious that, although acoustics have occupied the special attention of many scientists, no one has come forward to systematically utilize the balloon in the service of that all-important branch of science.

* Once in 1895, in the case of the famous Ham ghost, near Hungerford.

Proposed Memorial to Clerk Maxwell.

It is proposed to place in Corsock parish church, by half-guinea subscriptions, a suitable memorial of the late Prof. James Clerk Maxwell. There is already in the church a memorial to the memory of his revered father, John Clerk Maxwell, by whose influence and exertions the church was originally built. This church is chosen for the memorial, as Maxwell's connection with it through life was very close. He was led to it as a child by his father; taught in its Sabbath school; was ordained an elder within its walls, and acted as such up to the time of his death; gave liberally toward its endowment, and the first and largest subscription toward the manse; was a trustee of the church and properties, and otherwise interested himself in its behalf.

Correspondence.

House of a New Zealand Chief.

To the Editor of the SCIENTIFIC AMERICAN:

Allow me to call attention to a slip in your usually accurate paper. In the issue of October 8 the front page has a number of good views to illustrate Mr. Sidney Dickinson's lecture on New Zealand, but the first one, which is entitled "Front of Tribal Assembly House," is nothing of the kind. It is the gable end of a chief's food house or pátaka, a structure raised on posts and covered with thatch. The roof projects over the carved end and usually terminates in elaborately carved barge boards. The specimen figured, a very fine one, is now in the Bernice Pauahi Bishop Museum of Polynesian Ethnology and Natural History in Honolulu. WILLIAM T. BRIGHAM, Director.

Bernice Pauahi Bishop Museum, Honolulu, H. I., October 19, 1898.

Spirit Slate Writing.

To the Editor of the SCIENTIFIC AMERICAN:

Your exposés of tricks as practiced by spiritual fakes have been observed, and I am sorry to say that I believe you stopped too soon, if the prime object was to enlighten the people, for I have the best of reasons to believe that in no other way can that matter be given than through the sheets of your publication, for as such they will be accepted as worthy of consideration by at least those who will reap the most benefits from your articles. I do not think that there is any one person who can fully grasp the extent that the so-called spiritual manifestations are practiced in this country.

Salem, Ohio. F. F. R.

[We have so many letters commending Mr. Robinson's series of articles on "Spirit Slate Writing and Kindred Phenomena" that we have decided to publish the manuscript in book form, most of the work being unpublished. It gives us pleasure to announce that the book is now in press and will be published by the time this paper is issued.—ED.]

The 12-inch Versus the 13-inch Gun.

To the Editor of the SCIENTIFIC AMERICAN:

Although I agree with you most heartily in your agitation of the exchange of the new 12-inch gun for the 13-inch in the "Alabama" class, yet it seems to me that in recent comparisons in your paper the power of the 13-inch rifles with which it is proposed to arm the "Alabama" is underestimated.

Let me take, for example, Mr. Shute's letter in your last issue, where he compares the 12-inch British wire gun, with a muzzle energy of 33,020 foot tons, with our 13-inch gun, giving that only 33,627 foot tons energy. This is unfair, because the energy of the English gun is here calculated for smokeless powder and our gun only allowed brown powder. Now, our large guns are being supplied with smokeless powder, and that is what these guns should now be considered as using. The 13-inch gun will then have a muzzle velocity of 2,400 foot seconds, giving a muzzle energy of 43,922 foot tons. Further, Mr Shute does not think that our gun could be handled nearly as rapidly as his own.

If we take some actual results in the British navy, we find that the best rate of fire for the 12-inch gun is one round in 1 minute 4 seconds, and for the English 13·5-inch gun, one round in 1 minute 27 seconds. Now, our 13-inch gun is 8 tons lighter than the 13·5-inch gun, and, moreover, for the "Alabama" class, it will have a considerably improved mounting and breeching. It seems to me not unfair, then, to take its rate of fire as one round in 1 minute 15 seconds. Now, if we work out on this basis the fire energies per minute for the 13-inch and 12-inch gun, we shall get 35,956 foot tons for the American and 30,956 for the British gun.

Finally, it must be remembered that at normal battle range, say 1,500 yards, the 13-inch rifle would show a considerable proportionate increase of energy over the 12-inch, due to the fact that the lighter shell loses its velocity much more quickly. GEORGE B. MOODY.

Massachusetts Institute of Technology, Boston, Mass.

[It is true that by the use of smokeless powder the energy of the 13-inch gun would be greatly increased, but it would still be considerably less than that obtainable with the new pattern 12 inch gun, and its relative efficiency (obtained by dividing the energy by the weight of the gun) would be very low compared with the new weapon. The English 12-inch gun has a record of 47 seconds between two rounds with a trained crew. Our new gun, on account of the new breech mechanism, will be even more rapid in its fire. Granting the 13-inch would use smokeless powder, the argument is still overpoweringly strong in favor of replacing the 13-inch weapon by the new 12-inch on the "Alabama" class.—ED.]

PROF. VINCENJI has been examining the so-called holy water from a much frequented church in a Sardinian town. It swarmed with microbes, Löffler's bacillus among others. Cultures and inoculations identified the thing, and at the time there were four cases of diphtheria in the place, one terminating fatally.—The British Architect.

Miscellaneous Notes and Receipts.

The Dutch fishermen observe the precaution of killing the fish caught as soon as they reach the shore, while the French fishermen leave their booty to die of suffocation. It is to be desired that the Dutch custom be generally adopted, not only for reasons of humanity, but also because promptly killed fish will furnish a far better and more relishable meal.

The most recent investigations by Dr. Linden-Kosl have demonstrated that the starting point of the Gulf Stream does not lie in the Straits of Florida, but in the ocean districts between and near the West Indian Islands near Binioni. The quantity of warm water of the Gulf Stream is about sixty times as large as the water contents of all streams of the earth at their mouths.

Production of Baroscopes.—Dissolve 10 grammes of camphor, 5 grammes of saltpeter, 5 grammes of sal ammoniac, in 105 grammes of alcohol (90 per cent) and 45 grammes of distilled water. After filtering, fill glass tubes 2 centimeters wide and 50 centimeters long with this solution, cork up well below and above, seal and fix on boards by means of wire, similar to barometers. The changes of the solution signify the following: Clear liquid, bright weather; crystals at bottom, thick air, frost in winter; dim liquid, rain; dim liquid with small stars, thunder storms; large flakes, heavy air, overcast sky, snow in winter; threads in upper portion of liquid, windy weather; small dots, damp weather, fog; rising flakes which remain high, wind in the upper air regions; small stars in winter on bright sunny day, snow in one or two days. The higher the crystals rise in the glass tube in winter, the colder it will be.—Neueste Erfindungen und Erfahrungen.

To Protect Lead Pencil or India Ink Sketches.—The above drawings are protected from blurring by coating them with collodion to which two per cent of stearine from a good stearine candle is added. Lay the drawing on a glass plate or a board, and pour the mixture over, in the same manner in which the photographer treats his plates. After 10 to 20 minutes the drawing is dry, and entirely white, possessing a dull luster, and is so protected that it can be washed off with water, without fear of injuring it.—Die Kreide.

Remedy for Damp Cellars.—Take old preserve cans and put therein calcium chloride, a pound of this salt sufficing for a large cellar. The same attracts the water from the air, which collects in the cans. This, however, is not poured away, but is evaporated on a strong fire, whereby the salt crystallizes again and becomes fit for renewed use. Especially for potato cellars this process is very serviceable, since the sprouting of the potatoes, though not entirely prevented, is considerably retarded thereby.—Maler Zeitung.

Testing Commercial Chrome Yellow.—Many commercial chrome yellows contain admixtures for producing the right shade, such as lead chromate, clay, barium sulphate, calcium carbonate, calcium sulphate, etc. For analyzing a chrome yellow containing lead chromate, lead sulphate, barium sulphate, calcium sulphate, calcium carbonate, and clay, the following method is proposed: Treat 1 grm. of the finely powdered pigment at a moderate heat with 100 c. cm. of dilute hydrochloric acid in the proportion of 1 to 20, which is added in three installments. Allow to settle and pour the clear liquid through a filter. Wash out with warm water and estimate lime and sulphuric acid in the filtrate. The residuum is, at an ordinary temperature, treated with 50 c. cm. of ammonium acetate solution of 1·04 specific gravity. The solution must be neutral or faintly alkaline at most. Wash out the residuum with warm water. The filtrate, which contains lead sulphate, is brought to dryness in a weighed platinum crucible, and the lead is weighed as sulphate. The residuum from the treatment with ammonium acetate contains lead chromate, barium sulphate, and clay. It is suspended in 50 c. cm. of water and boiled with 25 c. cm. potash lye of 112 grms. of KOH in the liter. The lead chromate decomposes into soluble potassium plumbite and potassium chromate, while barium sulphate and clay remain unattacked and are separated in the usual manner. The chromic acid is estimated in a special portion of the substance, according to Bunsen's iodo-metric method.—M. Willeux, in the Bulletin d'Associété Bèlge, 1898, p. 163.

Social Life of Clerks.

Some people say that the private character of an employé should have no bearing upon his relations with his employer; that so long as he does his work satisfactorily it is nobody's business how he spends his time away from the store. This is a fallacious idea, however. In railroads, banks, and other lines of business there is strict watch kept upon the habits of employes, and if they are known to be spending their spare hours in dissipation, it is not long before they are dropped from their positions. Employers know that it is only a question of time when fast living means stealing.—The Keystone.

Science Notes.

The sanitary authorities of Sutton Surry, England, have gone into the perfume business in an unusual manner, for they are producing lavender on their sewage farm.—The British Architect.

At Stoke Newington, England, the local vestrymen recently rearranged part of the drainage system and constructed a ventilator in one of the streets. They failed to connect the ventilator with the sewer, and quietly awaited developments. To their great delight the result was entirely satisfactory. Letters of complaint regarding offensive odors were numerous, and when public resentment reached a climax, the local authorities complimented the writers on the strength of their imaginations.

Venice without its waters would be a far less picturesque place than it actually is. And such a state of affairs, we are led to believe, may eventually come about. The regular increase in the delta of the Po has been studied by Prof. Marinelli. Comparison of the Austrian map of about 1823 with the records of surveys made in 1893 shows that the mean annual increase during those seventy years has been about three-tenths of a square mile; and from all known data it appears that the total increase during six centuries has been about 198 square miles. The increase is continuing, and the Gulf of Venice is doomed in time to disappear. No immediate alarm need, however, be excited, for Prof. Marinelli calculates that between 100 and 120 centuries will elapse before the entire Northern Adriatic will have become dry land.—London Chronicle.

The berries of the yew have killed many persons, and it is pretty well known nowadays that it is not safe to eat many peach pits or cherry kernels at once. Among the garden plants commonly in vogue which possess a poisonous nature botanists mention the jonquil, white hyacinth, and snowdrop, the narcissus being also particularly deadly—so much so, indeed, that to chew a small scrap of one of the bulbs may result fatally, while the juice of the leaves is an emetic. There is enough opium in red poppies to do mischief, and the autumn crocus, if the blossoms are chewed, causes illness. The lobelias are all dangerous, their juice, if swallowed, producing giddiness, with pains in the head. Lady's slipper poisons in the same way as does poison ivy. The bulbs seem to be the most harmful. Lilies of the valley are also as poisonous. The leaves and flowers of the oleander are deadly, and the bark of the catalpa tree is very mischievous. The water dropwort, when not in flower, resembles celery, and is virulent.

In connection with the recent disastrous ending of the company that established works in Maine for obtaining from the ocean the gold contained in its salts, a statement appears in The Mining Press, of San Francisco, from Mr. Pack, assayer of the United States Mint in that city, concerning his own experiments in this line. He has found gold in the ocean water proper only in solution and amounting to about 0·5 of a grain to the ton—in value about two cents—the gold in the water of San Francisco Bay being probably about twice that amount, though largely in a finely divided state, only a portion being in solution. The quantity of gold and silver actually contained in the ocean water and the possibility of profitably extracting them has long been under discussion. Malaguti and Durocher's well-known experiments resulted in the discovery of silver in water, but no note is made of any gold. Later, in 1872, Sonstadt discovered gold in sea water, and though not stating the exact amount found, he reported it to be less than one grain to the ton of water. In a paper read before the New South Wales Royal Society on this subject Prof. Liversidge estimates the sea water of the coast in that region to contain a very small amount of gold to the ton, namely 0·5 grain.

The "Antarctic" having returned to Tromsö with the Swedish expedition under Dr. A. G. Nathorst, some notes of the results have been published. Bear island was surveyed and a good map was made, which shows that the "old maps are quite incorrect." The geological work was also successful. Previously only carboniferous strata were known, and an old rock without fossils. In this the expedition found fossils showing the age to be Silurian; and, besides, another series was discovered, the age of which is probably Devonian. The geologists also discovered fossils in the "Three Crowns," forming the top of Mount Misery, which will probably prove to be of Jurassic age. The geology of the little island is consequently of great interest. Some new zoological and botanical discoveries were also made. The expedition went as far north as 80° 14′ lat., and if it had reached there a little earlier might have easily gone still further north; but it appears that the scientific work of the expedition has been most successful; large geological, botanical, and zoological collections have been made. The geology, botany, and zoology of King Charles Land are now completely known, and important connections between the geology of Spitzbergen and that of Franz Josef Land have been established.

THE NAVIES OF THE WORLD.

I. GREAT BRITAIN.

The present article on the British navy is the first of a series on the navies of the world which will appear during the next few months in the columns of the SCIENTIFIC AMERICAN. The great popularity enjoyed by the SPECIAL NAVY EDITION and the large number of requests that have reached this office for a series of illustrated papers on the leading navies of Europe make it evident that the newly awakened interest in naval matters will render such a series particularly acceptable at this interesting and critical period of the world's history.

The British navy is selected for first consideration, as holding the same predominant position in the Eastern as our own navy does in the Western Hemisphere. Of the two chapters devoted to this navy, the first will deal with the battleships and armored cruisers, the second with the protected cruisers, gunboats, and torpedo craft.

Including all the new vessels that will be laid down in the private and government yards by the close of the year, the official lists show that the fighting ships of the British navy of all classes, from battleships to torpedo boats, make a grand total of 625 vessels. This total is made up as follows: Armored vessels, comprising battleships, coast defense vessels, and armored cruisers, 103; unarmored vessels, including protected cruisers, unprotected cruisers, and gunboats, 226; destroyers, 106; torpedo boats, 190.

The above estimate, it must be remembered, includes all vessels that appear on the official lists of the navy. Some of them are necessarily old ships whose slow speed and out-of-date armament would greatly restrict the sphere of their usefulness. While they are by no means obsolete and could render good service on the innermost lines of defense, or at the remote and less important stations of the empire, they cannot justly be included in an estimate of the modern British navy. By way of eliminating these older vessels, we will apply a scale of speeds, omitting all ships in the repective classes which fall below the speed limit. This test is a more representative one than might at first sight be supposed; for with the gradual introduction of superior armor, guns, and construction, there has always been a proportionate increase in the speed of war vessels.

Omitting, then, all battleships that fall below about 14 knots speed, coast defense vessels below 10 knots, armored cruisers below 17 knots, protected cruisers below 15 knots, and gunboats below 12 knots, we get the following results: Armored vessels, 96; including 54 battleships, 25 coast defense vessels, and 17 armored cruisers. Unarmored vessels, 194; including 97 protected cruisers of from 14,000 to 2,000 tons and 97 small cruisers and gunboats of 2,000 tons and less. Adding these totals to those of the destroyers and torpedo boats gives a grand total of 586 efficient and up-to-date vessels.

While there is, of course, great strength in numbers, the real fighting power of the British navy lies in its fleet of 54 seagoing battleships. These constitute the main line of defense, and if this line should ever be penetrated and its ships dispersed or sunk, all the other 500 vessels could not save the vast British empire from dismemberment or the "tight little isle" itself from invasion. It is a sound axiom in naval warfare, the naval warfare of steel armor and high-powered guns, that no vessel can fight outside of her class with any reasonable hope of success—not, at least, where the opposing ships are handled by crews of equal efficiency. Battleship must be opposed by battleship, cruiser by cruiser, torpedo boat by torpedo boat destroyer. A fleet of unarmored cruisers could no more lie in the line of battle against a fleet of armored battleships with any hope of success than a pygmy could fight a giant. The cruisers' guns would burst a storm of harmless shells against the battleship's belts and turrets, while the 12-inch shells of the latter would pierce the cruisers from side to side. Their light gun shields and casemates, moreover, would prove to be little better than shell traps, serving, as did the thin turret shields of the "Oquendo," at Santiago, merely to burst the heavy shells as they passed through and insure the death of the whole gun detachment which was sheltered (?) behind it.

Although the brunt of the battle will fall upon the line-of-battle ships, the cruisers and torpedo boats that accompany the opposing fleets would probably assist in dealing the decisive strokes when the ships of one or other side had been badly crippled. After a battleship's unarmored ends had been blown away, her engines or steering gear crippled, or her heavy guns dismounted, the armored cruisers and the more powerful of the protected cruisers might be trusted to close in and finish her—and this duty they would undoubtedly perform. But this always presupposes that the bulldog has had its teeth drawn, and such work can only be done by the battleship.

The 54 battleships may be subdivided most advantageously according to their age, according as they were built in the present or the preceding decade or at an even earlier date. Under this distribution we get 34 battleships 10 years old or less; 11 battleships over 10 and less than 20 years old; and 9 battleships that are over 20 years old and have been refitted and rearmed or are soon to be so.

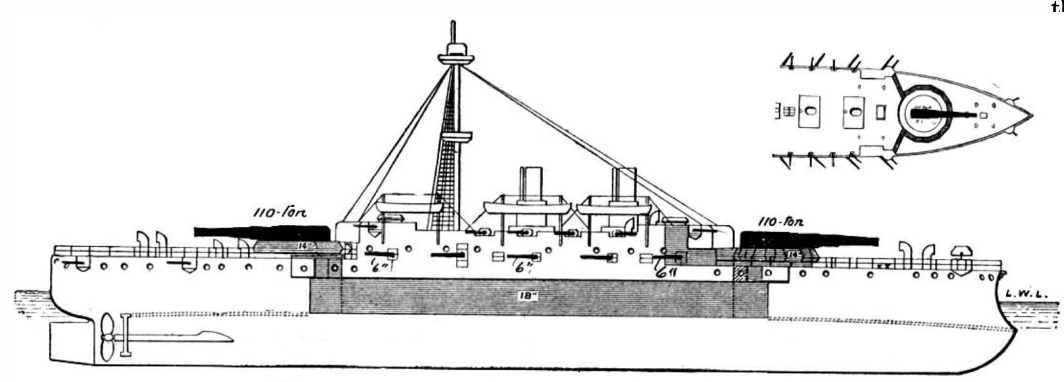
If asked to name the most characteristic features of these 34 ships, we would mention their size, seaworthiness, and speed, and in these respects they are peculiarly suited to the needs of a nation whose possessions are found in every quarter of the globe. The average size is over 14,000 tons, they all, with two exceptions, have a clear freeboard of from 20 to 25 feet, with a main deck extending unbroken from stem to stern, and the average speed is 18 knots.

Commencing with the oldest of these ships, we have the "Nile" and "Trafalgar," completed in 1890; sister ships of 11,940 tons, 16¾ knots, and 1,200 tons coal capacity. They are notable for their heavy armor, the belt being from 16 to 20 inches, the bulkheads from 18 to 14 inches, and the turrets 18 inches in thickness. The 16 to 20-inch armor is carried up to the main deck amidships and around the bases of the turrets, while above this is an armored redoubt of inch armor. The main battery onsists of four 67-ton 13½-inch uns, the secondary battery of ght 4·7-inch rapid-firers. The efensive qualities of these ships re excellent; the defects are the ow freeboard (about 13 feet, or he same as our ships of the Oregon" type) and the very ght secondary battery.

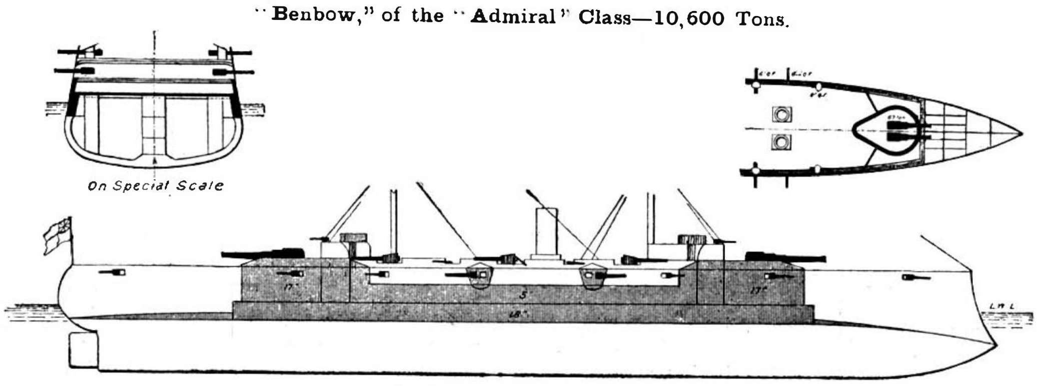
The next group of ships to be uilt was the 8 large vessels of he "Royal Sovereign" class, of hich the "Resolution," Plate 3, one. They were completed etween the years 1892 and 1895, nd were designed by Sir William White, the chief naval constructor, who has designed all the ater ships of the British navy, ncluding those of the Naval Defense Act of 1889. He insted that a warship must be eaworthy, commodious, comortable for the crew, carry her uns high above the water, and ave good speed and large coalarrying capacity, in addition to eing heavily armed and armord. To embody all these feaures involved a large ship, and ence the new vessels had a dislacement of 14,150 tons. They arry 1,800 tons of coal, are of 7·5 to 18·0 knots speed, and are rotected with compound armor s follows: Belt, 18 inches; gun ositions, 17 inches; bulkheads, 3 inches; and deck, 3 inches. The armament consists of four 3½-inch breech-loaders, ten 6-ich rapid-firers, and 38 smaller apid-fire and machine guns. The other ships of this class are he "Empress of India," the Hood," which differed from the thers in having her guns carried in turrets, the freeboard eing reduced to 14 feet, the Ramillies," "Repulse," "Resolution" (see Plate 3), "Revenge," nd "Royal Oak."

At the same time two smaller ut faster battleships were built, he "Barfleur" and "Centurion," whose particulars are as ollows: Displacement, 10,500 ons; coal, 1,240 tons; speed, 18½ nots; armor, 12-inch compound elt and bulkheads, 9 inches on un positions, and 2½-inch deck. The armament is light for ships f this size, consisting of four 10-nch breech-loading guns, ten 4·7-nch rapid-firers, and twentyine smaller guns.

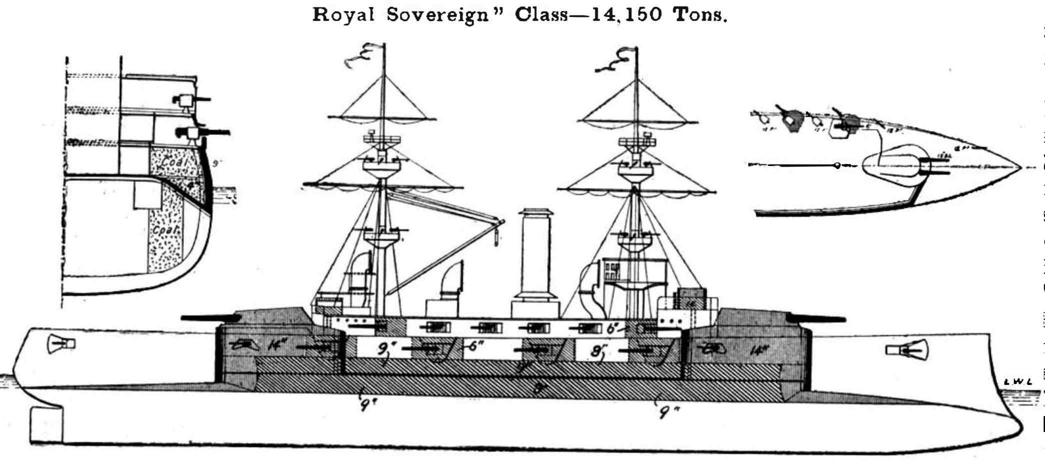
The next building programme included nine more huge vessels that were similar to the "Royal Sovereign" class but were larger and embodied such modern improvements as wire-wound guns and Harveyized steel. These are known as the "Majestic" class, after the first of them which was completed. The others are the "Jupiter," "Magnificent," "Mars," "Cæsar," "Prince George," "Hannibal" (see Plate 2), "Illustrious," and "Victorious." As compared with the "Royal Sovereign" class, the "Majestics" have 750 tons more displacement, carry about the same amount of coal, and have the same speed. The higher quality of the steel used in their armor (Harvey steel) permits the thickness to be reduced, and hence a larger area of the ship can be covered. Thus in the "Royal Sovereign" class the main belt extends vertically only as high as the flat protective deck; while in the "Majestics" the 9-inch belt is carried up to the gun deck (see diagram). Moreover, the



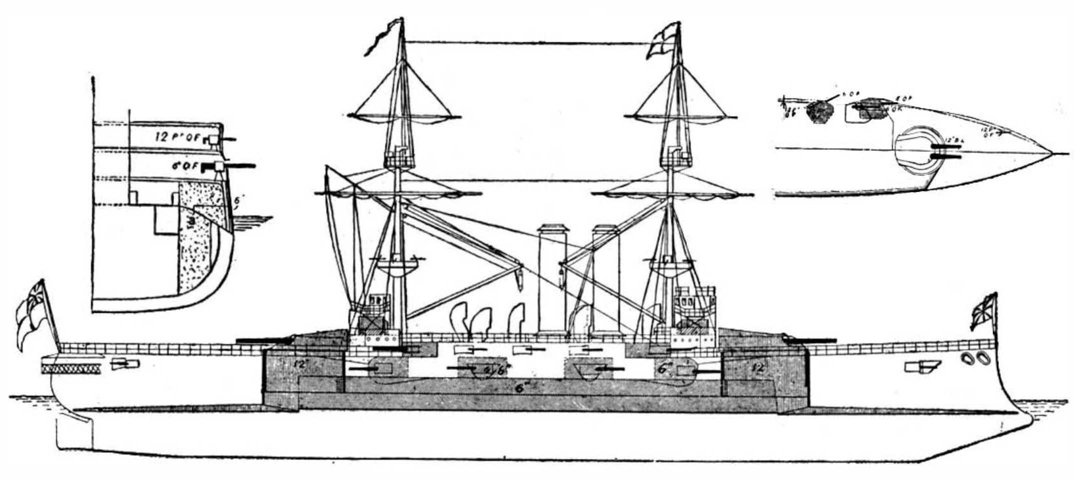
"Benbow," of the "Admiral" Class—10,600 Tons.



"Royal Sovereign" Class—14,150 Tons.

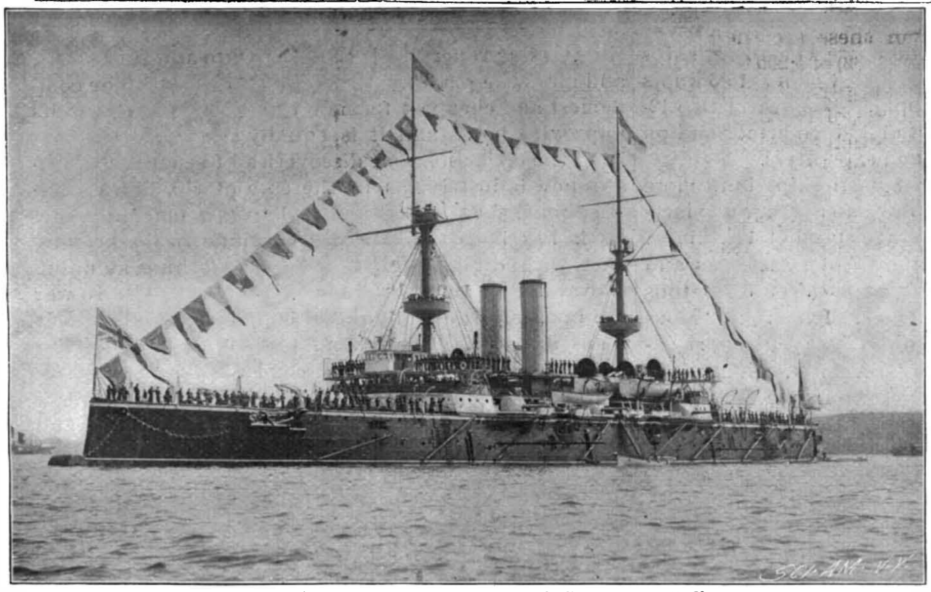


"Magnificent" Class—14,900 Tons. Also "Formidable" Class, with continuous waterline belt and two additional 6-inch guns on main deck.



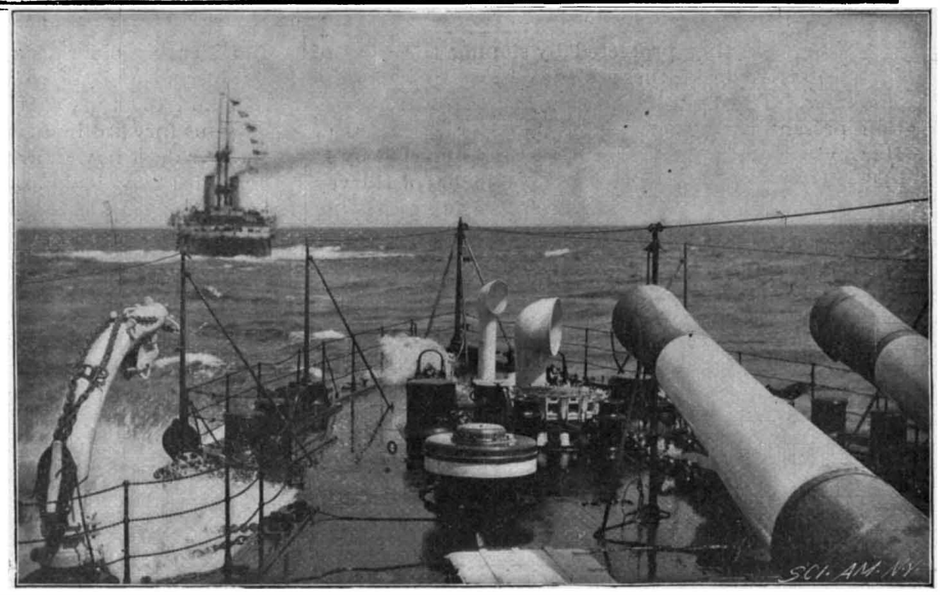
"Canopus" Class—12,950 Tons.

NAVIES OF THE WORLD—I. GREAT BRITAIN.



3.—First-class Battleship "Resolution." "Royal Sovereign" Class of Eight Ships.

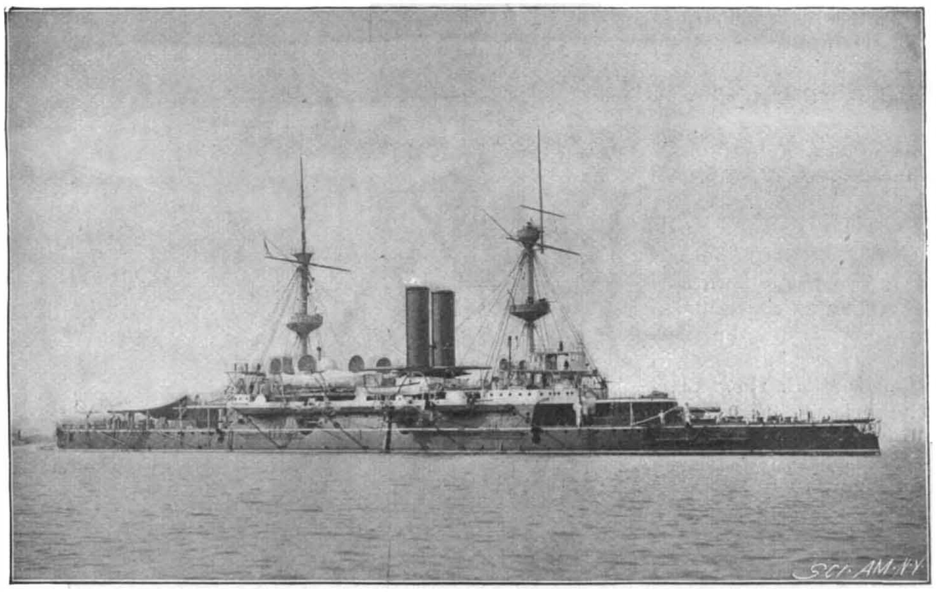
Displacement, 14,150 tons. **Speed,** 17·5 to 18 knots. **Bunker Capacity,** 1,800 tons. **Armor:** Belt, 18 inches; barbettes, 17 inches; casemates, 6 inches; deck, flat, 3 inches. **Armament,** four 13½-inch, ten 6-inch rapid-firers, thirty-six smaller guns. **Torpedo Tubes,** 7 (two submerged). **Complement,** 730. **Date,** 1892 to 1895.



4.—Forward Pair of 13½-inch, 67-ton Guns of the "Resolution," Mounted in Barbette.

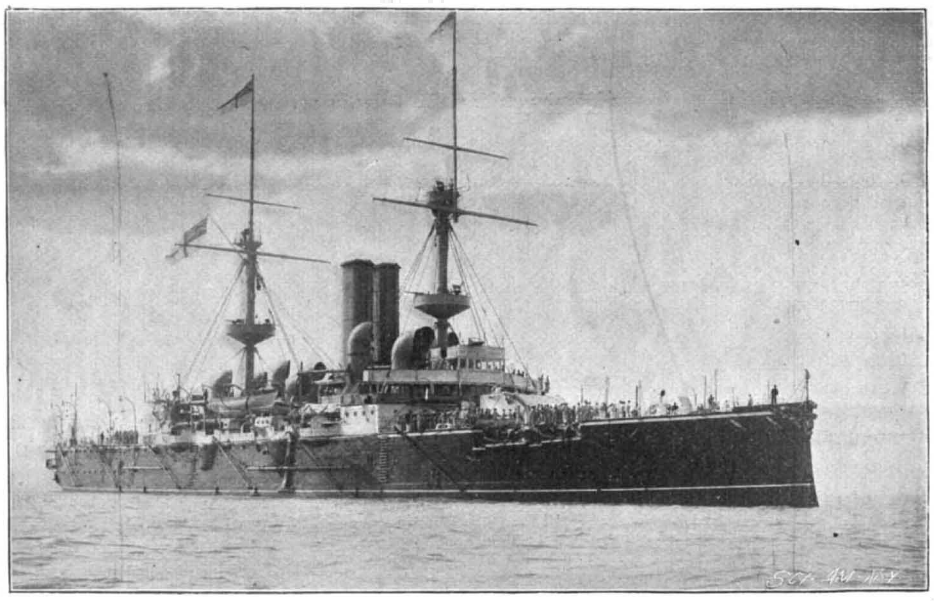
Height of guns above sea, 27 feet.

Note: In the "Resolution" class the large guns are mounted in the open. In the "Majestic," "Canopus," and "Formidable" classes they are protected at the breech by hoods of 6-inch steel.



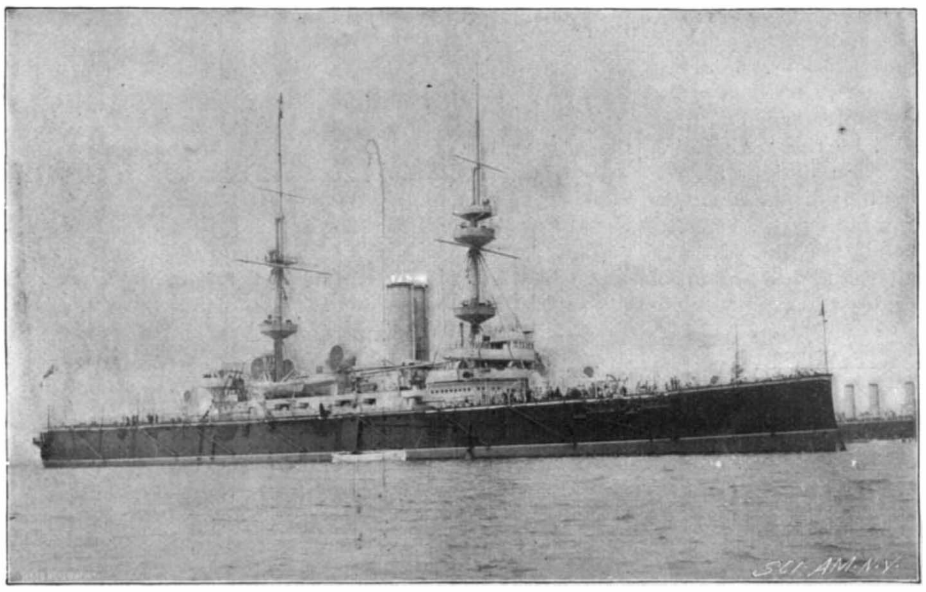
5.—First-class Turret Battleship "Hood." One of this Type.

Displacement, 14,150 tons. **Speed,** 17·5 knots. **Bunker Capacity,** 1,800 tons. **Armor:** Belt, 18 inches; turrets, 17 inches; casemates, 6 inches; deck, flat. 13 inches. **Armament,** four 13½-inch, ten 6-inch rapid-firers. thirty-six smaller guns. **Torpedo Tubes,** 7 (two submerged). **Complement,** 730. **Date,** 1893.



6.—First-class Battleship "Barfleur." Also "Centurion."

Displacement, 10,500 tons. **Speed,** 18·5 knots. **Bunker Capacity,** 1,240 tons. **Armor:** Belt, 12 inches; barbettes, 9 inches; deck, 2 to 2½ inches. **Armament,** four 10-inch, ten 4·7-inch rapid-firers, twenty-seven smaller guns. **Torpedo Tubes** 7 (two submerged). **Complement** 606. **Date,** 1894.

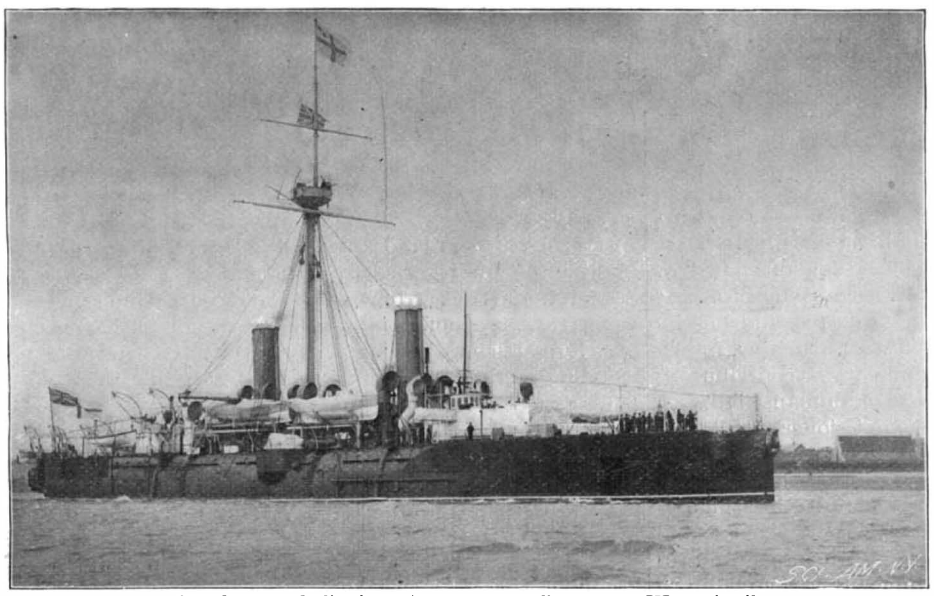


7.—First-class Battleship "Renown." Also six of "Canopus" Class, improved "Renowns" of 12,950 tons and 18¾ knots.

Displacement, 12,350 tons. **Speed,** 18 knots. **Coal,** 1,800 tons. **Armor,** 8-inch belt, 10-inch barbettes. **Armament,** four 10-inch, ten 6-inch rapid-firers, fourteen 3-inch rapid-firers, twenty-one small guns. **Torpedo Tubes,** 5 (two submerged). **Complement,** 674. **Date,** 1896.

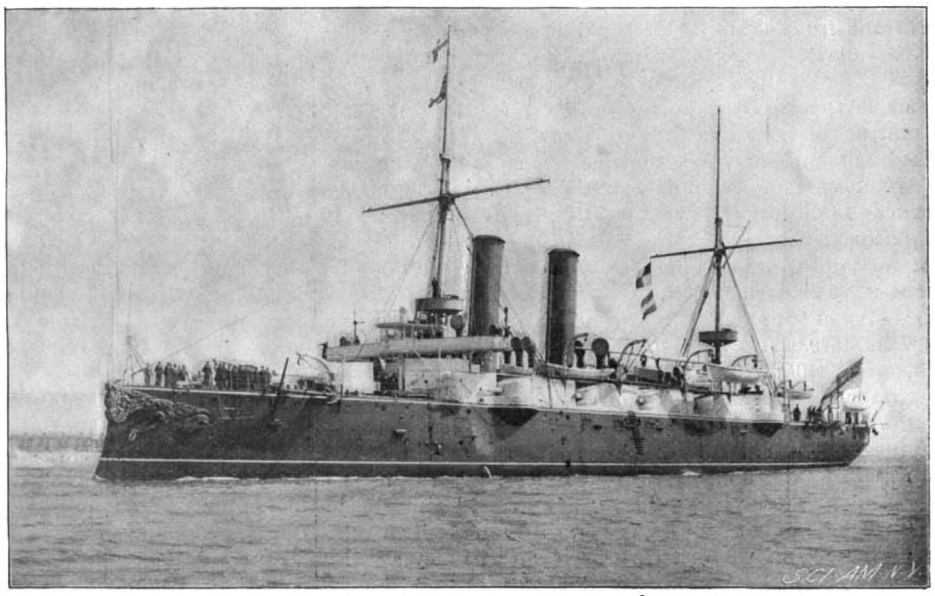
8.—Forward 10-inch Guns of the "Renown."

The six ships of the "Canopus" class (18¾ knots) carry four 12-inch guns and twelve 6-inch rapid-firers.



9.—Armored Cruiser "Imperieuse." Also "Warspite."

Displacement, 8,400 tons. **Speed,** 16·7 knots. **Bunker Capacity,** 1,130 tons. **Armor:** Belt, 10 inches; barbettes, 4½ inches; deck, 2 inches flat, 4 inches slopes. **Armament,** four 9·2-inch, ten 6-inch rapid-firers, twenty-four smaller guns. **Torpedo Tubes,** 6. **Complement,** 544. **Date,** 1886.



10.—Armored Cruiser "Australia." Seven of this Class.

Displacement, 5,600 tons. **Speed,** 18 knots. **Bunker Capacity,** 900 tons. **Armor:** Belt, 10 inches; barbettes, 4½ inches; deck, 2 inches on flat, 3 inches on slopes. **Armament,** two 9·2-inch guns, ten 6-inch rapid-firers, twenty-two smaller guns. **Torpedo Tubes,** 4. **Complement,** 484. **Date,** 1888.

From Photographs by Symonds & Co., Portsmouth, England.

NAVIES OF THE WORLD—I. GREAT BRITAIN.

waterline is further protected by sloping the sides of the protective deck, these slopes being 4 inches in thickness. The belt, the slopes, and the coal protection present a resistance equal to 18 or 19 inches of Harveyized steel. The main battery is protected by 14 inches and the secondary battery by 6 inches of Harvey steel. The armament is also more powerful, consisting of four 12-inch wire-wound guns, twelve 6-inch wire-wound rapid-firers in casemates protected by splinter bulkheads, eighteen 3-inch rapid firers and twelve 3-pounders, besides eight machine guns.

In both the "Royal Sovereign" and the "Majestic" the main battery is carried "en barbette," that is to say, the guns fire over the walls of a fixed barbette, and have no turret armor to protect them. This system has been permanently adopted in the British navy on account of the greater height at which the guns can be carried, and the greater ease of manipulation, owing to the fact that only the guns, and not the turrets and guns, have to be trained. In the "Royal Sovereign" the gun crew are entirely exposed, but in the "Magnificent" and all later ships, a sloping shield, 6 inches in thickness (equal to about 9 inches vertical), protects the breech and the gun-crew.

The next vessel, the "Renown" (1896), showed a tendency to return to smaller displacement, and obtain higher speed at the expense of the armament, the latter being absurdly light for a ship of her size. The particulars are as follows: Displacement, 12,350 tons; speed, 18 knots; armor belt, 8 to 6 inches; gun positions, 10 inches; armament, four 10-inch, ten 6 inch rapid-firers, fourteen 3-inch, and twenty-one smaller guns.

Following the "Renown" come the six vessels of the "Canopus" class (Plate 7), which are a great improvement over the former ship. Although they are only 600 tons larger, they have a much higher speed, a larger coal supply, and carry 12-inch in place of 10-inch guns, besides two extra 6-inch rapid-firers. The particulars are: Displacement, 12,950 tons; speed, 18¾ knots; coal supply, 1,850 tons; belt armor, 6 inches, associated with 3-inch sloping deck; gun positions, 12 inches. Armament, four 12-inch, twelve 6-inch rapid-firing, and eighteen smaller guns. These ships will be completed this and next year. The other ships of the "Canopus" class are the "Albion," "Glory," "Goliath," "Ocean," and "Vengeance."

The next programme, which is now under construction, called for three sister ships, the "Formidable," "Implacable," and "Irresistible," which are to be even larger than the "Majestic" class and of at least half a knot greater speed, steaming 18 knots under natural draught. The armament is to be increased over that of the "Majestic" by the addition of two 6-inch rapid-firers, while the side armor will be carried out to the stem and stern.

Under the supplementary vote this year for the increase of the navy, three other 15,000-ton ships, similar to the "Formidable," were ordered. All six of these ships will be armored with Krupp steel, and the weight so saved in armor will be put into speed, armament, or ammunition supply. The three latest ships are to be of 18¾ knots speed.

Passing now to the eleven battleships over ten and less than twenty years old, we notice first what are known as the "Admiral" class, completed between 1886 and 1889. There are six of these: The "Benbow," "Collingwood," "Howe," "Rodney," "Anson," and "Camperdown." The smallest is the "Collingwood," of 9,500 tons, and the other five are of 10,600 tons displacement, while the speed of all six is about 16¾ knots per hour. The main armament of the "Collingwood" consists of four 12-inch guns (not wire-wound); that of the "Benbow" of two 16¼-inch 110-ton guns; and that of the other four ships, of four 13½-inch 67-ton guns. The freeboard of the ships is low (about 13 feet), and the main battery is carried "en barbette." The armor is of the compound type, 18 inches in the belt, 16 inches in the bulkhead, from 12 to 14 inches in the barbettes. The secondary battery of six 6-inch rapid-fire guns is carried amidships, without any protection. The coal capacity is 1,200 tons. The good features of these ships are their heavy main battery, the heavy armor of belt and barbettes, the good speed, and large coal capacity. The weak points are the low freeboard, rendering the ships not very seaworthy; the feeble secondary battery, and the lack of armor protection to the latter and to the bases of the barbettes, which are not covered by the armor belt.

Another and more serviceable ship is the "Sanspareil," 1889, sister ship to the ill-fated "Victoria." She is of 10,470 tons and 17·2 knots, with belt and turret armor 16 to 18 inch, compound. She carries as main armament two 110-ton guns in a forward turret and one 10-inch rifle aft. In broadside are twelve 6-inch rapid-firers, supplemented by twenty smaller guns.

Other ships are the "Colossus" and "Edinburgh," of 9,420 tons and 14·2 knots, armed with four 12-inch rifles in turrets, five 6-inch slow-firers and twenty smaller guns. They carry compound armor 16 to 18 inches thick. They are of the central citadel type like our own "Texas," and, with their coal supply of 970 tons, are fairly serviceable ships.

Considerably older than these are the turret ships "Conqueror" and "Hero" (1882) of 6,200 tons, 15·3 knots speed, and 650 tons coal supply. They carry two 12-inch guns forward in a turret of 12-inch armor and on the upper deck have four 6-inch slow-firers.

The third class includes nine battleships built more than twenty years ago. They have an average displacement of 8,872 tons and an average speed of 14·1 knots. The largest is the "Dreadnaught," of 10,820 tons and 13·7 knots, the smallest the "Rupert," of 5,440 tons and 14 knots speed. Some of them, such as the "Monarch," "Alexandra," and "Sultan," have been re-engined, reboilered, and partially rearmed with modern guns. It is proposed to rearm and refit the others.

The twenty-five coast defense vessels range from the big "Inflexible," of 11,880 tons, 24 inch armor, 12·8 knots speed, and armament of four 16-inch 80-ton guns, to the "Orion," of 4,870 tons, 12 knots speed, 8 to 12-inch armor, and main armament of four 12-inch muzzle-loading rifles. Among these are included the old broadside line-of-battle ships of the seventies, such as the "Agincourt," 10,600 tons and 12 knots, the "Nelson" and "Northampton," of 7,610 tons and 13½ knots, and others of a similar class. They are fine, high freeboard ships, and afford good gun platforms. They have protective decks, from 5½ to 12-inch side and citadel armor, and, if rearmed, would prove to be highly serviceable for coast defense. There is a strong movement afoot to carry out this rearmament, and it will probably be done.

Great Britain has only of late years taken up again the construction of that invaluable type of ship, half battleship, half cruiser—the armored cruiser. At present she has nine; two of the "Warspite" class (Plate 9) and seven of the "Australia" class (Plate 10). The particulars of each type are given below the illustrations of the respective ships and call for no special remark. The distinction between the armored and the protected cruiser is that the former carries side armor in addition to the protective deck. In both the "Warspite" and the "Australia" the belt is 10 inches in thickness. The sister ship to the "Imperieuse" is the "Warspite," and the sisters to the "Australia" are the "Aurora," "Galatea," "Immortalité," "Narcissus," "Orlando," and "Undaunted." The date of these ships is from 1886 to 1889.

Realizing the immense importance of the type and prompted, no doubt, by the example of the French government, England has commenced the construction of eight large armored cruisers of the "Cressy" class. The first four of these are of the following dimensions, etc.: Displacement, 12,000 tons; speed, 21 knots; coal supply, 800 tons; belt, 6 inches; deck, 2 inches on flat, 3 inches on slopes; gun positions, 6 inches, all of Krupp steel. Armament, two 9·2-inch rifles, twelve 6-inch rapid-firers, and seventeen smaller guns. The other ships of the class will be the "Aboukir," "Hague," and the "Sutlej." The designs for the other four call for ships of 14,000 tons displacement, 23 knots speed, and great steaming radius.

In another issue we shall conclude the description of the British navy, with illustrations and descriptions of the unarmored ships, such as protected cruisers, gunboats, and torpedo craft.

Patents.

The Keystone has this to say about patents: The applications for patents during the year 1897 outran the record of any previous year. Invention is certainly not on the decline, and the man with an idea and a model is in stronger evidence than ever. In no time in the history of the Patent Office has there been any sign of a marked relapse in inventive ingenuity—here and there perhaps a parenthesis, as in times of panic and trade stagnation; but as a rule each year as it came along added recruits to the army that never halts in the march of progress. The following table marks the line of increase for each decade since 1840:

For the ten years	beginning	1840	the average	is	1,186·9
"	"	1850	"	"	3,884·2
"	"	1860	"	"	11,724·5
"	"	1870	"	"	20,259·5
"	"	1880	"	"	33,443·9
" eight years	"	1890	"	"	41,479·0

From the character and number of the patents granted in 1897, it is evident that the fertile mind of the inventor is fructifying in every field of endeavor. Ingenuity is not exclusive. It isolates nothing. It covers every imaginable form of device, and has its improving hand on every type of tool, machine, implement, or apparatus helpful to industry or contributory to the comfort and convenience of human kind. In every annual report of the Commissioner of Patents we have a list of devices that are as diversified as was the population of Noah's Ark, and in the literature of ingenuity nothing more clearly demonstrates the ubiquitous character of inventive genius. It ranges from a shawl pin to a monster crane, and from a mouse trap or a lemon squeezer to a tubular boiler, an electric motor, or a superb locomotive. It represents the democracy of genius, in which nothing is too small to be important or too great to be unapproachable. Everything is its property. It pares a potato and shells peas, and girds the planet with telegraph cables. The commonest and cheapest form of tool does not escape its improving hand, and it is equally as available in utilizing the epoch-making discoveries of science. It creates new industries, as in the case of the bicycle, the telephone, electric appliances, linotype machines, etc. As it has been doing it will continue to do, keeping pace with discovery and declaring nothing as unimprovable that man has devised or constructed. In war as in peace it is equally potential and irrepressible. It plans arms of precision and propels explosives under the waters and above them, conceives and fashions a murderous pellet of lead, and gives the surgeon a Roentgen ray by which the bullet can be located and life be spared.

The Photography of Colors and Photochromy of Metals.

Very recently, M. Joseph Girard, preparator of chemistry at the Faculty of Sciences of Paris, has found it possible to obtain exactly analogous colors to those obtained by Edmond Becquerel, without the intervention of the electric current, as used by Becquerel.

The body to be deposited is obtained in the state of a very tenuous precipitate in a liquid in which it floats, although sometimes of greater density. The metallic object, previously very carefully cleaned, having been immersed in the liquid, attracts the precipitate through capillary phenomena and causes it to deposit in a layer of which the thickness increases with the duration of immersion of the object to be colored.

M. Girard remarked that the most tenuous precipitates are those that are obtained by reduction, and that the tenuity seems to increase with the number of the intermediate reactions. These facts led him to select hyposulphite of sodium, sulphureted hydrogen, or sulphide of sodium as a reducing agent. The first of these substances gave him the best results, because of the numerous double hyposulphites that it is capable of giving with metals, and the best known of which are the two double hyposulphites of sodium and silver, that are so important in photography. But M. Girard did not wish to use silver salts on account of their high price and their great sensitiveness to light. He prefers to them copper or lead salts.

When a solution of sulphate of copper or acetate of lead is mixed with one of hyposulphite of sodium, there forms a double hyposulphite of sodium and copper or lead, both of which are soluble salts. When the liquid is heated, the double salt is decomposed at about 70 or 80 degrees into a sulphide, which precipitates in extremely fine particles. It is at this moment that the object to be colored (which may be of copper, tin, nickel, zinc, etc.) must be immersed in the bath and kept as near as possible to its free surface. It is then observed to become covered successively with the various colors of the spectrum in their usual order—red, orange, yellow, green, blue, indigo, violet. After the object has assumed the tint desired, it is removed from the bath. The color is due to the interferences of incident light with the light which, after traversing the thin layer of deposited sulphide, has been reflected upon the metallic plate in order to traverse the layer of sulphide again. However, as the latter is slightly colored, it seems as if there were here a mixture of interference and absorption colors. This is a point that M. Girard has not as yet thoroughly elucidated.

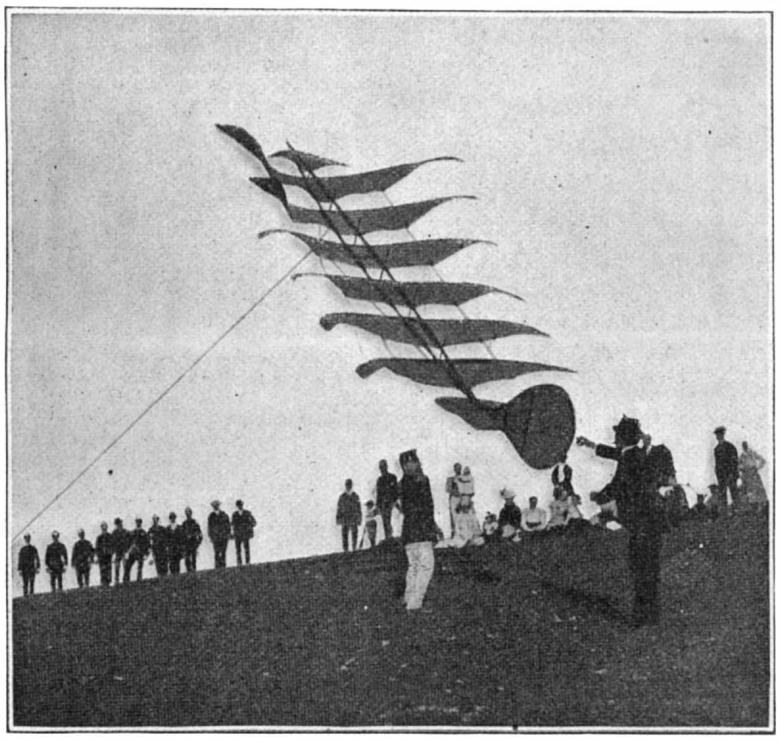
The best results have been obtained by employing a mixture of sulphate of copper and acetate of lead. The low price of the products used for forming the photochromic bath, the immense variety of colors that may be obtained with this bath alone, and the facility of the manipulations will not fail to contribute toward the success of this new industry—the photochromy of metals.

But M. Girard's researches have, aside from an industrial scope, an interesting scientific one. There is a widespread prejudice that consists in believing that the blue, violet, and ultra-violet radiations of the spectrum are alone capable of causing chemical reactions, and from this comes the very improper name of chemical rays that is often given this region of the solar spectrum. Now, red, orange, and green radiations are capable of giving rise to chemical reactions that, although different from those produced by blue and violet rays, are none the less interesting. M. Girard has, in particular, found in his researches that the metallic sulphides, especially copper sulphide (Cu_2S) and silver sulphide (Ag_2S), are very sensitive to red radiations. This property will not fail to be utilized for the preparation of isochromatic photographic plates, which will prove very useful for the photography of colors. Moreover, upon preparing a sensitive plate by the method employed in the photochromy of metals, M. Girard has been able to obtain a photograph of the solar spectrum in colors. So, we shall not be astonished if his researches end before long in a new solution of the very interesting problem of the photography of colors.—La Revue Technique.

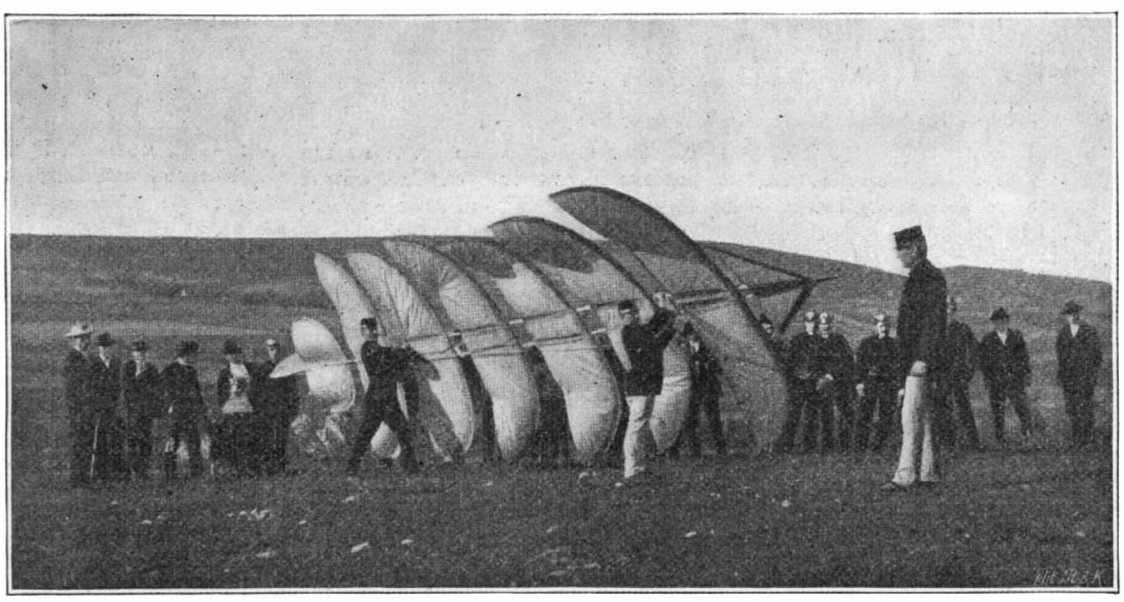
A NEW REGISTERING KITE.

Experiments in the use of kites for meteorological purposes recently tried by A. L. Rotch, of the Blue Hill Observatory, Boston, Dr. Hergesell, of the Meteorologischen Landesinstitut, Alsace - Lorraine, and others, have given such very satisfactory results as to arouse the greatest interest in all scientific circles. Although the kite is known to possess many advantages over the balloon as a vehicle for self-registering meteorological instruments, it is generally with considerable reluctance that such expensive apparatus are intrusted to one of these devices, which are still very uncertain, for no one has yet succeeded in making a kite that is steady and safe in all winds. Many experiments have been undertaken with kites of various kinds for the purpose of overcoming these difficulties, and some of special interest were made by Hugo L. Nikel, treasurer of the Vienna Flugtechnischer Verein, with his new kite, which is constructed according to the interrupted plane principle, and is provided with a horizontal and vertical rudder. The string is attached to the kite in such a manner that the latter can always assume the position most favorable to its ascent. The experiments with this kite, which was 26 feet long and 13 feet wide, weighed 16·5 pounds and had a surface covering an area of 129 square feet, were made last August at Krzeszowice, near Krakow, and were remarkably successful. The first ascent was a perfect success, although the wind was very light—scarcely 8 feet per second.

The kite rose with a rush, and the entire length of the string, 1,115 feet, was let out by using a windlass with a band brake. With a wind of about 20 feet the kite carried a load of about 66 pounds, which is more than even the heavy instruments weigh. The motion of the kite was quiet and uniform, only a slight tacking indicating a change of wind. At a height varying from 190 feet to 330 feet the only effect of a change in the pressure of the wind was to cause a moderate ascension when the force of the wind increased, and a slow descent when the wind pressure decreased. The use of a tail or landing line, such as is generally attached to a balloon, proved most satisfactory. The line was 33 feet long and hung from the neck of the rudder. The experiment of securing a dynamite cartridge to the landing line and exploding it at a considerable height was tried, and the result showed that the kite could, if desired, be used for the purpose of producing rain by explosions. We are indebted to Illustrirte Zeitung for the engravings and particulars.



REGISTERING KITE MAKING ITS ASCENT.



NEW REGISTERING KITE RECENTLY TESTED IN GERMANY.

Insect Drunkards.

Many plants and shrubs secrete pollen and nectar that are intoxicating, and the blossoms of such plants are especially sought out by certain insects, which seem to enjoy a debauch on the natural stimulants as much as does a veritable human drunkard a like carouse on the artificial potations of mankind whose basis is alcohol.

The juices of certain of the Compositæ are likewise toxic, and are eagerly devoured by some beetles, who seem to have discovered this quality in the plants. But the flower which probably supplies more insect drunkards than any other is the cosmos, an autumn annual which blooms luxuriantly in this section of the country (Kentucky) from the middle of September to late in November, unless cut down by severe frosts.

This is a beautiful flower, both as to foliage and blossom, and is, comparatively speaking, quite hardy. Both C. diversifolius and C. bipinnatus secrete pollen and nectar that are distinctly toxic to the insects who feed upon them. Furthermore, this toxic substance is capable of exerting a marked influence on the human being, as I will point out further along in this paper.

My attention was first drawn to the intoxicating properties of this annual one warm, bright day in October, 1897. I was observing the eagerness with which a large number of bumblebees, small beetles, butterflies, and an innumerable host of flies of many genera and species were seeking the blossoms, when I saw a bumblebee suddenly fall to the ground from an open flower and lie supine, feebly moving its legs in an aimless and purposeless manner.

I took it up, and, after careful examination, concluded that it had been attacked by some bumblebee ill that was beyond my powers of diagnosis. Soon, however, I saw another and another and another bee succumb to this mysterious illness. I noticed also that many of the coleopterous, lepidopterous, and dipterous insects were likewise falling to the earth (there were hundreds of these créatures on the ground) or feebly crawling about on the plants.

These observations led me to believe that there was something toxic in the pollen, or nectar (probably in both, for the beetles could not easily get at the nectaries), and that these insects were simply intoxicated.

This view was confirmed later on, for I frequently saw the intoxicated individuals partially recover from the effects of the intoxicant and again seek the seductive blossoms. This fact was easily demonstrated by marking some of the prostrate bees with a paint of zinc oxide and gum arabic; the marked bees, in the course of an hour or so, were to be seen on the flowers, greedily sucking the nectar from the nectaries.

An intoxicated bee was carried to my laboratory for dissection and microscopic investigation. This insect was so drunk that, when placed upon its back, it had the greatest difficulty in getting upon its legs; yet, when a cosmos blossom was brought within two inches of its head, the bee thrust out its proboscis and staggered toward it! It immediately began to suck the nectar, and, in a few moments, tumbled over, a drunken, senseless, almost inert little mass—a victim of appetite!

The cosmos is rich in pollen, and a half-teaspoonful was therefore soon collected by shaking the blossoms over a sheet of note paper. This pollen I swallowed. In about fifteen minutes I noticed an acceleration of the pulse rate (three beats to the minute) with a feeling of increased warmth; there was also slight exhilaration.

The nectaries of the depollenized flowers were macerated in boiling water and then distilled. A half drachm of the distillate was then injected hypodermatically in my left arm. Almost immediately there was marked acceleration of the pulse beat (six to the minute), with greatly increased volume. A feeling of exhilaration supervened, which lasted for some twenty-five or thirty minutes, and which was followed by slight nausea.

There was considerable pain at the seat of the injection, and a tumefied spot as large as a hen's egg made its appearance, which gave me some alarm for several days; I feared that an abscess was in process of formation. The swelling gradually disappeared, however, and in five days the arm regained its normal appearance, save for a slight discoloration, which eventually faded away.

From these experiments it would seem that the toxic principle is to be found both in the pollen and in the nectar. This conclusion is further strengthened by the fact that numerous beetles were found in an intoxicated condition on the blossoms and on the ground beneath the plants. These insects evidently eat the pollen; having no proboscides, they cannot reach the nectaries, hence must content themselves with the "next best dish on the table."

JAMES WEIR, JR., M.D.

PRESIDENT SCHURMAN, in his recent address at the opening of the fall semester at Cornell University, makes the statement that the age of freshmen at entrance has been falling continuously for three years, although the standard of requirements for admission was at the same time continuously rising. "The average age of Cornell freshmen was nineteen years and eleven months in 1895–96, nineteen years and eight months in 1896–97, and nineteen years and seven months in 1897–98. This seems to show," continues Dr. Schurman, "that the high schools of the country are quite rapidly increasing in efficiency." It would be interesting and valuable to know also the relative physical condition of these youths compared with their predecessors.

The Current Supplement.

The current SUPPLEMENT, No. 1195, contains several articles of remarkable interest. Our readers have so many times wished for directions for making an electric automobile vehicle that we take great pleasure in acceding to their request, and present them with full directions and working drawings for making a thoroughly practical and economical electric vehicle. This article was written by Charles T. Child, the electrician, and it is accompanied by detailed illustrations which show every step in the manufacture of the carriage, the motor, and the batteries. It is an interesting and important paper, and forms one of a series of articles which we are publishing on methods of making electrical apparatus, of which the electrical furnace was the first. "Diamonds in Meteorites" is an interesting article by Mrs. E. M. Souvielle. "The Decorah Ice Cave and Its Explanation" is an original article, by A. T. Kovarik, and is accompanied by illustrations taken directly from photographs. "Mammals" is an interesting lecture by Prof. Witmar Stone. "The Stomach and Phonendoscope" shows the curious application of the use of an amplified stethoscope. "Table of Atomic Weights," by T. W. Richards, is a most important article to those who are interested in chemical matters. It is accompanied by tables. "The Present Status of the Electrical Engineer" is the inaugural address of Prof. A. E. Kennelly before the American Institute of Electrical Engineers.

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RECENTLY PATENTED INVENTIONS.

Engineering Improvements.

ROTARY ENGINE.—REUBEN P. JARVIS, Smith Centre, Kan. The purpose of this invention is to provide a rotary engine of simple construction and effective operation, so constructed that the motive agent may be utilized to the utmost profit. The engine has a cylinder with an inlet-port and two open exhaust-ports. A fixed shaft having a crank-arm extends into the cylinder. A piston is eccentrically mounted in the cylinder, and turns loosely on the shaft. In rocking trunnions carried by the piston, piston-heads are fitted to slide in slots in the piston-rim. The inner ends of the piston-heads are pivotally connected with the crank-arm of the fixed shaft. The heads are adapted successively to pass the ports, so that live steam is taken at the inlet-port, a portion of the steam being exhausted at the first exhaust port and the remainder at the last exhaust-port.

Mechanical Devices.

CIGAR-BUNCHING MACHINE.—ABRAHAM FRANK, New York city. The object of this invention is to provide a cigar-bunching machine of simple construction, which machine may be successfully used with the bench of any cigar-making apparatus. The present machine is provided with a table, an apron for the table, and a roller for the apron, the three parts operating to roll a bunch to proper shape without unduly packing the tobacco. The size of the pocket in the apron in which the material for the bunch is placed, may be readily increased or decreased in size.

Miscellaneous Inventions.

TENSION DEVICE FOR LOOM-SHUTTLES.—FRANCISQUE DAVID, St. Etienne, France. This invention seeks to provide a simple construction by means of which the spool may be retarded more or less, according as the tension on the thread decreases or increases. To this end the invention consists of a shuttle having a support or body portion, a spool mounted therein, and a brake normally engaging and retarding the spool. The brake embodies means engaged by the thread as the latter passes from the spool, so that tension on the thread serves to relax the brake.

MEASURING AND REGISTERING DEVICE FOR LOOMS.—ALFRED and JOHN BENTLEY, Paterson, N. J. The measuring and registering device provided by these inventors comprises a casing, a fixed stud, and a registering wheel arranged within the casing and provided with a hub extending through an opening in the casing. The registering wheel is adapted to turn loosely upon the stud and to slide thereon. A fastening device is carried by the hub and is arranged to engage the stud. A spring is adapted to press on the registering wheel and coacts with the fastening device to hold the registering wheel in operative position. A friction-wheel is adapted to be operated by the passage of the fabric in engagement with the wheel. Mechanism is provided for driving the registering from the friction wheel.

CAKE-TURNER.—CHESTER E. MACDUFFEE, Narragansett, R. I. The purpose of this invention is to provide a cake-turner so constructed that the blade may be conveniently turned from a point at or near the handle, without changing the position of the hand or of the handle. With this end in view, the inventor provides the shaft of the blade with a pinion made to engage a rack within the casing in which the shaft is journaled. A spring is located within the casing and bears with one end upon the casing and with the other end upon the stem of a button. By pressing the button, the spring is placed under tension, and the shaft of the blade is given a half turn. When the button is released, the retractile force of the spring will cause the shaft automatically to resume its initial position through the medium of the rack and pinion.

RAILWAY CATTLE-GUARD.—CHARLES H. MATH'S, Bowie, Tex. The guard provided by this invention is so constructed that it will be automatically opened by the action of the wheels of the engine of an advancing train, and closed when the train has passed. The cattle-guard consists of a gate made in three sections,—a central section between the tracks adapted to operate in a direction parallel with the rails of a track, and side sections located outside of the track-rails. The side sections are spring-controlled and are arranged to operate in a direction transversely to the rails of the track. A connection is provided between the outer and the central sections of the gate. Trip-bars operating the gate-sections are arranged to be acted on by the wheels of a train.

CUFF-HOLDER.—CHARLES V. RICHARDS, Skowhegan, Me. This cuff-holder consists of two flat arms connected with each other at one end so as to move toward and from each other at their free ends. The contiguous edges of the arms are provided with notches communicating with each other by means of two slots gradually decreasing in width in the direction of the joined ends of the arms. The inner slot is wider than the outer slot.

CRIBBAGE-BOARD.—WILSON G. ROSS and JOHN J. REID, Benicia, Cal. The purpose of this invention is to provide a counting-board in which the use of pins will be dispensed with, thus obviating the danger of losing the counting devices. The board comprises a frame, a bar mounted to rotate therein and having numerals on two of its surfaces, guide-rods in the frame, and counters movable longitudinally of the guide-rods. As the counts are made, the counters are lifted relatively to the guide-rods and moved along until the proper number is reached. As the higher numbers are required, the bar is rotated or rocked to bring the requisite numbers into view.

ADVERTISING DEVICE.—LANCE J. TOFFELMIER and ALBAN HEIRON, San Leandro, Cal. To provide a new advertising machine, especially designed for use in street and railway cars, public buildings and other places, and constructed in such a manner that the machine is actuated by a moving door, window, or the like, to display the advertisements attractively, this inventor has devised an apparatus consisting principally of a revolving cylinder adapted to carry advertising cards on its periphery, a gearing to rotate the cylinder, and a mechanism to rotate the gearing intermittently on the cylinder in one direction only. The mechanism, as before stated, is actuated by a hinged or sliding door, window, or other movable part.

CIRCULAR SAW.—SIEVE T. JOHNSON, Trinidad, Cal. This circular saw comprises a central section having a peripheral screw-thread and a flange projecting radially beyond the screw-head, in connection with a rim-section having saw-teeth at its outer periphery, and a female screw-thread at is inner periphery, fitting the screw-thread on the central section, and securing screws extending through the rim and flange parallel with the axis. The saw is especially designed for sawing shingles. The cutting section is made removable.

FIRE-ESCAPE.—HENRY VIEREGG, Grand Island, Neb. This fire-escape belongs to that class in which a trackway or rail is mounted to run around the top of a building. On this trackway a carriage moves. A ladder is provided which is secured to a wheel running over the track. A shaft is mounted at the upper portion of the ladder and is driven by an endless chain passing over a wheel secured to the shaft. In descending from the building, the chain is grasped with the hands and the weight of the body causes the person to be carried downward. In order to regulate the speed of the descent, a centrifugal governor controlling a strap-brake is used in addition to a hand-brake.

VEHICLE FOR COLLECTING HOUSEHOLD REFUSE OR OTHER MATERIAL.—SAMUEL L. KINSBRUNER, Friedenau, Germany. This invention provides a receptacle having an opening, adjacent to which a frame is hinged and adapted to engage a garbage-box or the like. A closing lid is secured to the frame and has a catch to engage the cover of the box. Connections between the lid and the frame enable the lid with the box-cover to be moved away from the frame and box when the latter are turned. The apparatus may be mounted on wheels to permit ready transportation of the garbage collected.

WIRE SPRING MATTRESS.—JACOB S. KNECHTEL and ROBERT G. VINCENT, Hanover, Canada. The wire spring mattress of these inventors comprises side rails; terminal cross-beams, one of which is secured to the rails, the other being adjustably secured thereon; side rods extending longitudinally; links for supporting the rods from the side rails; and a wire fabric formed of strands having coils extending alternately on opposite sides and having diagonal connecting links for joining adjacent coils of adjacent strands. The coils on the sides of the fabric are engaged by the side rods; and the ends of the strands are formed into loops for removable connection with pegs on the terminal beams. The several sections can be readily taken apart, thus permitting the mattresses to be packed in pairs for transportation.

METHOD OF PLANTING SEED.—ISAAC J. JENKINS, El Paso, Ill. The purpose of this invention is to provide a rapid and convenient means of planting, and to prepare the seed so that the farmer may readily determine the exact amount of seed required to plant a given piece of ground. The invention consists of a tubular casing comprising a fabric of coarse mesh. The seeds are arranged in the order in which it is desired that the plants shall appear, and are held in the desired position by the elasticity of the fabric. The tubular casing thus prepared is planted in any suitable manner.

CHECKING DEVICE.—ELI C. EAGLESFIELD, Berlin, Wis. Connected with a bit and sleeves located over the ends of the bit, is a check consisting of a strap passed through the rings of the bit and through the sleeves. The strap in its passage through the rings of the bit is formed into a chin-strap, a nose-band, and check-straps. An adjusting device is provided for the end of this check-strap and a connection with the crotch-strap. This check-strap enables a horse to be thoroughly controlled, preventing him from running or pulling to the side.

EXTENSION-CHAIR.—JAMES G. BULKLEY, New York city. This invention is an improvement in extension-chairs of that type in which the parts may be extended to form a couch. The chair has a back normally extending below the seat. Guides at the rear edge of the seat permit the back to be raised and swung to the rear on a pivot. A rod extending between the arms of the chair has its ends bent to enter holes in the arms, whereby the back may be supported in different positions. Swinging legs are pivoted to the upper end of the back. Eyes in the back and legs are adapted to receive the bent ends of the rod, whereby the rod may act as a brace for the back. Above a fixed seat-board a removable seat-board is located, the forward edge of which is adapted to be received by a slot in the frame of the chair to support the removable seat-board at an angle.

BELT-TIGHTENER.—ELIAS A. BIGELOW, Dash, Mich. This belt-tightener comprises a frame pivoted to swing bodily and two rollers at different distances from the pivot of the frame. The rollers are spaced to bear on the opposite runs of a belt, each roller describing its own arc, without changing its distance from the other roller when the frame swings on its pivot. The rollers being located at different distances from their pivotal supports, give, in effect, levers of different lengths. This principle is used to produce an automatic tightening within certain limits; and these limits are altered when necessary by adjusting devices.

CLEANER FOR SEED-COTTON.—EDWARD HART, Victoria, Texas. This cotton cleaning machine is provided with a laterally oscillating concave bed or cradle, having spaces for the escape of dust or dirt. A rotary stirrer and fan composed of arms having boards secured at points removed from their outer ends, works in the concave bed or slatted cradle.

CUSPIDOR-CARRIER.—CHARLES C. CORLEW, Fresno, Cal. The collapsible carrier provided by this inventor comprises a main rectangular frame, hinged guards and hinged retaining frames both of rectangular form. Hinged bottoms are connected with the main frame. Means are provided for locking the guards, retaining frames and bottoms in their open operative positions.

PORTABLE JAIL.—WILEY S. KING, Darlington, S. C. This portable jail is mounted on wheels and has barred inclosing walls and a series of bunks on opposite sides of a central aisle. The jail is especially designed for use in imprisoning convicts employed in many parts of the country in constructing roads. In order that the jail may be conveniently stored and transported, the inventor has provided means for facilitating transportation. The bunks furnish means whereby the prisoners are provided with sleeping accommodations.

CLAMPING-ATTACHMENT FOR HARNESS.—JAMES N. FARLOW, Lander, Wyo. This invention seeks to provide a simple device to supplant the use of buckles. The device in question consists of a looped clamping frame having diagonally-disposed side bars extended between a top cross-bar and a lower cross-bar, and a clamping bolt passing through alined perforations in the straps to be clamped, which perforations lie between the cross-bars of the clamping-frame. A winged nut is used in connection with the clamping-bolt.

Designs.

BOX-LID SUPPORT.—JOSEPH L. CONWAY, Sioux City, Iowa. The leading feature of this box-lid support consists in a front flap, having a doubled-up extension, and an arm leading from the lower edge of the back flap at angles thereto. The support is applied to a box so that the previously mentioned arm will rest upon the box, while the front flap will cover the edge of the lid toward the front. Advertising matter may be inscribed upon the flap.

CUP OR SIMILAR ARTICLE.—JOHN W. HANLEY, New York city. In this design the inner and outer surface of the vessel are divided into rectangles by vertical and horizontal lines, and in these rectangles pictorial figures are sketched. The bottom of the cup contains a sun or similar radiating figure.

WALL PAPER.—HARRY WEARNE, Rixheim, Germany. Six designs, as follows: 1. Striped panels of fine vertical lines interspersed with alternate panels of rose garlands and panels of festooned bars on each side of a line of floral figures. 2. Horizontally striped panels alternating with vertically striped panels on which are bouquets of flowers with connecting sprays extending across the panels. 3. Bouquets of roses and buds of various sizes arranged on a wave background simulating watered silk. 4. A central rectangle with dots around inner edge and short vertical lines across the middle. The rectangle is surmounted by a scroll having foliate extensions from the ends of which hang foliate pendants. To these pendants are fastened floral sprays terminating at the ends of the rectangle. Above the scroll is a floral bow. Below the rectangle is a foliate figure, and under this a bouquet with bell center and foliate bell pendant at the bottom. 5. A fanciful foliate center figure arched over by decorated scrolls which support a star-shaped panel. The panel is surmounted by C-shaped scrolls and a foliate spray. 6. Two upright rustic posts and next to the left one a narrow rustic ladder. Vines with rose shaped flowers are trained on the posts and ladder.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for 10 cents each. Please send the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

GLUCOSE IN CONFECTIONERY. A Statement from the National Confectioners' Association of the United States. Report from the National Academy of Sciences; Letter from Dr. Cyrus Edson, Commissioner of Health. Philadelphia: Confectioners' Journal Print. 1898. Pp. 11.

TWELFTH ANNUAL REPORT OF THE COMMISSIONER OF LABOR, 1897. Economic Aspects of the Liquor Problem. Washington: Government Printing Office. 1898. Pp. 267.

THE BUSINESS GIRL. By Ruth Ashmore. New York: Doubleday & McClure Company. Philadelphia: Curtis Publishing Company. 1898. Pp. 175. Price 50 cents.

The author is on the editorial staff of the Ladies' Home Journal, and is, therefore, undoubtedly able to give admirable common sense advice to girls, for this paper, like our own, has a Notes and Queries Department, and these letters of inquiry will certainly give a good indication of what girls wish to know. The frontispiece is a beautiful photogravure of Ruth Asmore's desk, though what connection it has with the volume we fail to understand.

DIE LIQUEUR-FABRIKATION. Von August Gaber. With illustrations. Vienna: A. Hartleben. Pp. xvi, 400. Price, paper, $1.35.

"Die Liqueur-Fabrikation" is a desirable addition to the monographs constituting the admirable Chemisch-Technische Bibliothek published by Hartleben. Like most of the other works of the series which we have noticed in this column, the present work on the manufacture of liqueurs is characterized by the same exhaustive treatment. True to his principles, the author has described in his work only those methods which have been actually tried and which have shown their value on more than one occasion. Taken as a whole, this seventh edition of Gaber's work bids fair to uphold the good name already earned by previous editions.

DIE KITTE UND KLEBEMITTEL. Von Sigmund Lehner. Vienna: A. Hartleben. Pp. viii, 134. Octavo. Price, paper, 60 cents.

In the present fifth edition of this admirable monograph on cements and adhesives the author has endeavored to embody only those formulæ among the vast number of recipes known in the various trades which have proved really useful. Since, in the manufacture of machinery and in the erection of gas and waterworks, the need of useful cements for the purpose in hand has often been felt, Herr Lehner has incorporated in his work directions for making the best cements known in these industries. In everyday life it often happens that one finds it necessary to repair broken glass and porcelain ware, and for this reason the recipes given for this purpose have been selected with more than usual care. The descriptions of the making of glues and stone cements will no doubt find favor with many a builder. The tanner, the maker of Indiarubber articles, the manufacturer of machinery, the upholsterer, the glazier, the bookbinder and the dentist will find here the best recipes for making the cements used in their arts.

BIRDS THAT HUNT AND ARE HUNTED. Life Histories of One Hundred and Seventy Birds of Prey, Game Birds and Water Fowls. By Neltjie Blanchan. With Introduction by G. O. Shields. New York: Doubleday & McClure Company. 1898. Forty-eight colored plates. Pp. 359. Price $2.

The volume before us is a beautiful one, and it may be regarded as one of the triumphs of modern bookmaking that such a handsome volume can be produced at such an astonishingly low price. It is beautifully printed and handsomely bound in green silk cloth, with a rich green top, which has heretofore been largely relegated to the cook-book. We are glad to see, however, that the use of colored edges is coming into vogue. Nothing is more appropriate than a neatly colored edge to match the binding, and some of the effects produced are very artistic, as in the present instance. The system of reproduction used in the plates is most admirable, and while the volume caters in a great measure to the sportsman, it is the hope of the author and editor that the sportsmen may learn to hunt more and more each year without guns; for all true sportsmen are lovers of nature. The time has come when the camera may and should to a great extent take the place of the gun. Several enthusiasts have demonstrated that beautiful pictures of wild birds may be made without taking their lives. We heartily commend this volume to all lovers of nature.

MANUAL OF DETERMINATIVE MINERALOGY. With an Introduction on Blowpipe Analysis. By George J. Brush. Revised and enlarged. With Entirely New Tables for the Identification of Minerals. By Samuel L. Penfield. Fifteenth Edition. First Thousand. New York: John Wiley & Sons. London: Chapman & Hall, Limited. 1898. Pp. 312. Price $3.50.

The present volume is the fifteenth edition of a work which is well-nigh classic. As far as the English language is concerned, it is the last word on determinative mineralogy, and the many tables which it contains will enable any one to accurately determine minerals, provided they have a good knowledge of blowpipe analysis, and this book is calculated to give them such a knowledge. It is freely illustrated by 375 engravings. It is a standard text book in many colleges, and the enormous sale of a book of this kind is alone evidence of its great value. The analytical tables for the identification of the minerals are an outgrowth of tables of Von Kobell as modified by Prof. Brush. The introduction, however, of a large number of new species since 1874 has necessitated a complete rearrangement of the minerals. The tables have been so developed that tests of characteristic mineral constituents furnish the chief means for identification; thus, identifying minerals, students may gain possession of important information concerning the chemical composition of compounds. The distribution of minerals in the tables and statements concerning their chemical and blowpipe characters have been verified in almost all cases by experiments made upon well authenticated specimens in the Brush collection at New Haven.

THE PHILIPPINE ISLANDS AND THEIR PEOPLE. A Record of Personal Observation and Experience. With a Short Summary of the More Important Facts in the History of the Archipelago. By Dean C. Worcester. New York: The Macmillan Company. London: Macmillan & Company, Limited. 1898. Pp. 529. Price $4.

The Philippine Islands at the present time are an all-absorbing topic of interest, so that this volume appears at a most opportune time. During the years 1870-74 Dr. J. B. Steere made an extended trip for the purpose of gathering zoological specimens and ethnological material, and in the course of his travels visited the Philippine Islands. We have already published in the SCIENTIFIC AMERICAN a number of Dr. Steere's papers on the subject. Dr. Steere's trip tempted others to visit this little known field, and another trip was planned by him in 1887-88, and the author of the present volume was one of those who went on the expedition. In 1890 the author made a second trip, and the volume before us is the fruit of his explorations in this comparatively unknown world. It is a very interesting volume and is handsomely printed and illustrated.

ANNUAL REPORT OF THE STATE GEOLOGIST OF NEW JERSEY FOR THE YEAR 1897. Trenton, N. J.: The John L. Murphy Publishing Company. 1898. Pp. 368.

The excellent work accomplished by the Geological Survey of the State of New Jersey is well known to all who are in any way interested in the science of geology. The present volume is fully up to those which have preceded it.

A HANDBOOK OF ENGINEERING LABORATORY PRACTICE. By Richard Addison Smart. First Edition, First Thousand. New York: John Wiley & Sons. London: Chapman & Hall, Limited. 1898. Pp. 290, 16. Price $2.50

This volume is intended primarily as a manual for the use of students in the routine of experimental work in steam engineering, strength of materials and hydraulics. The author is associate professor of experimental engineering at Purdue University, an institution which possesses an elaborate equipment, including a locomotive testing plant. The book is admirably arranged, and the diagrams and illustrations which elucidate the text are excellent. It is an admirable text book, and there is no doubt that it will be well received by those who are interested in steam engineering.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

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Minerals sent for examination should be distinctly marked or labeled.

(7522) L. J. M. asks: How to bleach beeswax? A. Pure white wax is obtained from the ordinary beeswax by exposure to the influence of the sun and weather. The wax is sliced into thin flakes and laid on sacking or coarse cloth, stretched on frames resting on posts to raise them from the ground. The wax is turned over frequently, and occasionally sprinkled with soft water, if there be not dew and rain sufficient to moisten it. The wax should be bleached in about four weeks. If, on breaking the flakes, the wax still appears yellow inside, it is necessary to melt it again, and flake and expose it a second time, or even oftener, before it becomes thoroughly bleached, the time required being mainly dependent upon the weather. There is a preliminary process, by which, it is claimed, much time is saved in the subsequent bleaching. This consists in passing melted wax and steam through long pipes, so as to expose the wax as much as possible to the action of the steam; thence into a pan heated by a steam bath, where it is stirred thoroughly with water and then allowed to settle. The whole operation is repeated a second and a third time, and the wax is then in condition to be more readily bleached.

(7523) C. A. M. asks: 1. Have you published drawings, dimensions, and descriptions of a projection lantern? If not, can you recommend some small handbook with such? A. See SCIENTIFIC AMERICAN, No. 8, vol. 61, and 25, vol. 58. Also SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 847 and 889, price 10 cents each by mail. 2. Where can I find descriptions and formulas for the manufacture of carbon paper? A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 1144, price 10 cents by mail. 3. What is the candle power of a Welsbach burner, and can one get stronger ones than the ones ordinarily used? A. We should estimate the light to be from 25 to 40 candles. We do not know that any larger size is made. 4. What is the candle power of a petroleum burner with one flat 2½ inch wick and with more than one wick? A. Such a wick may give 30 candles. A lamp with two wicks is generally used, the wick set obliquely to the line of collimation. More than two wicks are not advised, since the consumption is less perfect, the light less white, and the odor very much stronger. 5. Would it not be advantageous to use more than one lamp, and should they be placed one behind the other, or abreast? A. No; but if used, place them one behind the other.

(7524) W. T. B. asks: 1. Would it be practical to attempt to convert the small hand dynamo described in SUPPLEMENT, No. 161, to a plating machine? A. We do not advise the winding of handpower dynamo for plating. Its output would be about the same as that of a plating battery, while it is not possible to drive it by hand for the time necessary for plating. 2. Has there ever been an article written in your paper on the construction of a plating machine? A. SUPPLEMENT, No. 793, price 10 cents, contains the necessary changes to adapt the 8 light dynamo for plating. 3. Is there any method of removing finger spots on Russia sheet iron pipe? A. Rub the spots with alcohol on a rag to clear the grease, and then rub with dry stove polish or graphite.

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